

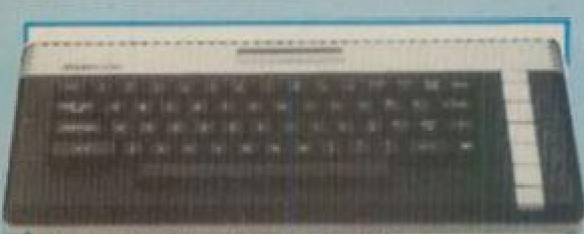
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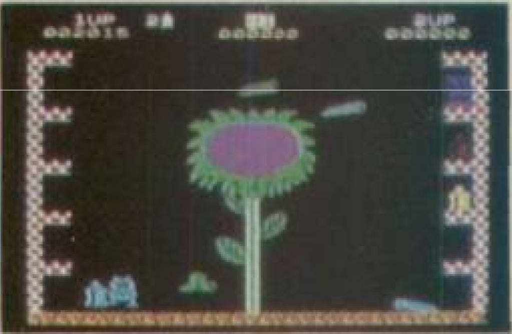

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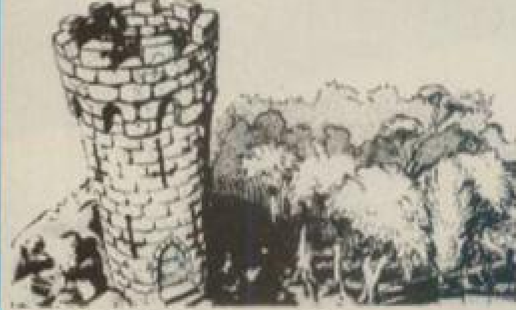
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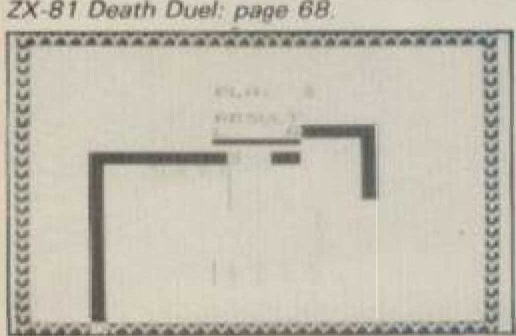
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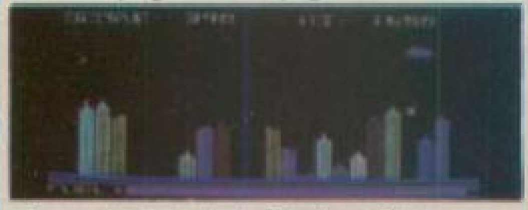

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Star games Shortlist: page 51.


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Why the BBC Micro? It might be fairer to let someone else answer that question.

"The BBC Microcomputers are the limousines of home computers. The graphics are probably the best of any machine in this class. You are paying for a smart machine which would not disgrace the home of a professional." *Video World, Feb. '83.*

"Its design has given the BBC Micro an unrivalled potential for business, educational and serious home applications. It has been equipped to function as the heart of a system which can be expanded to suit its owner's need." *Which Micro & Software Review, Feb. '83.*

"The most attractive and exciting feature of the BBC Microcomputer is its enormous potential for expansion which will allow a highly expansive system to be built-up." *Deborah Carruthers, Which Micro, June '82.*

"They (the graphics) are tremendously exciting, and they are one of the features that make this machine stand out head and shoulders above everything else that is available in the market place at this time." *Dave Futcher, Educational Computing, May '82.*

"It is expandable and has a powerful BASIC. It has superb sound and graphics, the software is readily available and the price is right." *Mr. A. D. Alles, a BBC Micro owner from Hampshire.*

"The basics are easy to follow. My wife has developed a program for teaching our daughter French vocabulary. Our daughter uses it mainly for games and simple programming." *Dr. A. Yarwood, a BBC Micro owner from Co. Durham.*

"It is a very powerful computer. My husband has written his own data base. I have been writing programs and programming games. Even the children have written small programs." *Mrs. A. M. Thomas, a BBC Micro owner from Devon.*

"No other computer can offer such ease of use when dealing with complex sound effects." *Which Micro, June '82.*

"It isn't often a journalist can sit down to write about a computer with the certain knowledge that he has never seen a nicer machine." *Guy Kewney, Personal Computer World, Dec. '82.*

"It has got huge potential. Besides playing the games, the whole family are learning basic programming." *Mr. P. S. Green, a BBC Micro owner from Staffordshire.*

"Everything possible seems to have been done to ensure that this is not a 'dead end' machine..." *Paul Beverley, Personal Computer World, July '82.*





Perhaps we could just add that the BBC Micro is the machine which was chosen to be at the heart of the BBC's massive Computer Literacy Project.

It is also the machine which, having won the Department of Industry's blessing, will account for over 80% of the computers bought by British schools this year.

And now for some facts about the machine itself.

The BBC Micro is light, compact and, with a conventional electric typewriter keyboard, easy to get the feel of.



It can be loaded from virtually any cassette recorder. And there is a wealth of ready-made programs available covering games, education and business subjects.

The BBC Micro uses BBC BASIC, a sophisticated version of the most popular computer language.

However, as your confidence and fluency grow, it can be adapted to switch to other languages.

It can also become a word processor, with the facility to link with a second processor for high-powered business use.

A disc drive unit can also be added. And with an adaptor, the BBC Micro is the first micro to be able to pick up programs from the Micronet–Prestel system. Another adaptor converts your TV into a Teletext receiver, with further ability to download programs.

All this for only £399.

The most sophisticated version of the BBC Micro, the Model B, is only £399. The basic Model A is £299. (Both come with a "Welcome cassette" and comprehensive introductory manual.)

They are both available from John Lewis, selected branches of Boots or local stockists.

Alternatively, if you would like to order a BBC Micro B with your credit card, or if you want the address of your nearest stockist, just phone 01-200 0200.

Or, you can buy a Model B by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants.

Your order will be despatched by fully insured courier.

Finally, you can also use the coupon simply to get full reprints of the articles from which the press cuttings featured have been taken.

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The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.

See the BBC Microcomputer System at The Acorn User Exhibition at The Cunard Hotel, London, W6. August 25-28.

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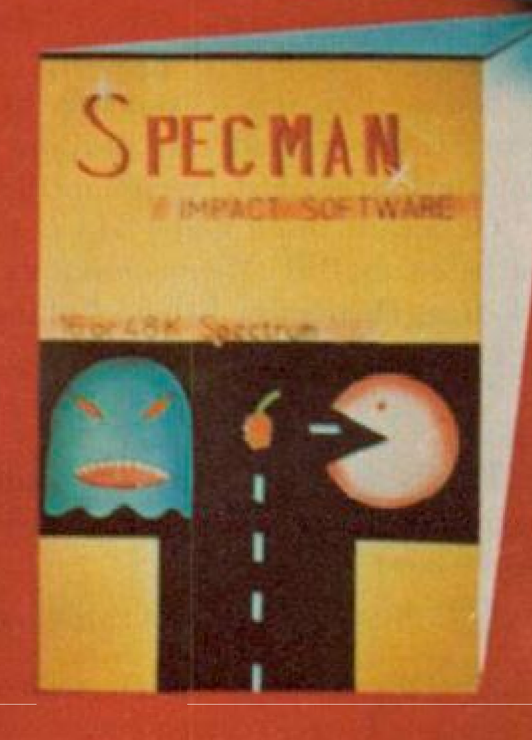
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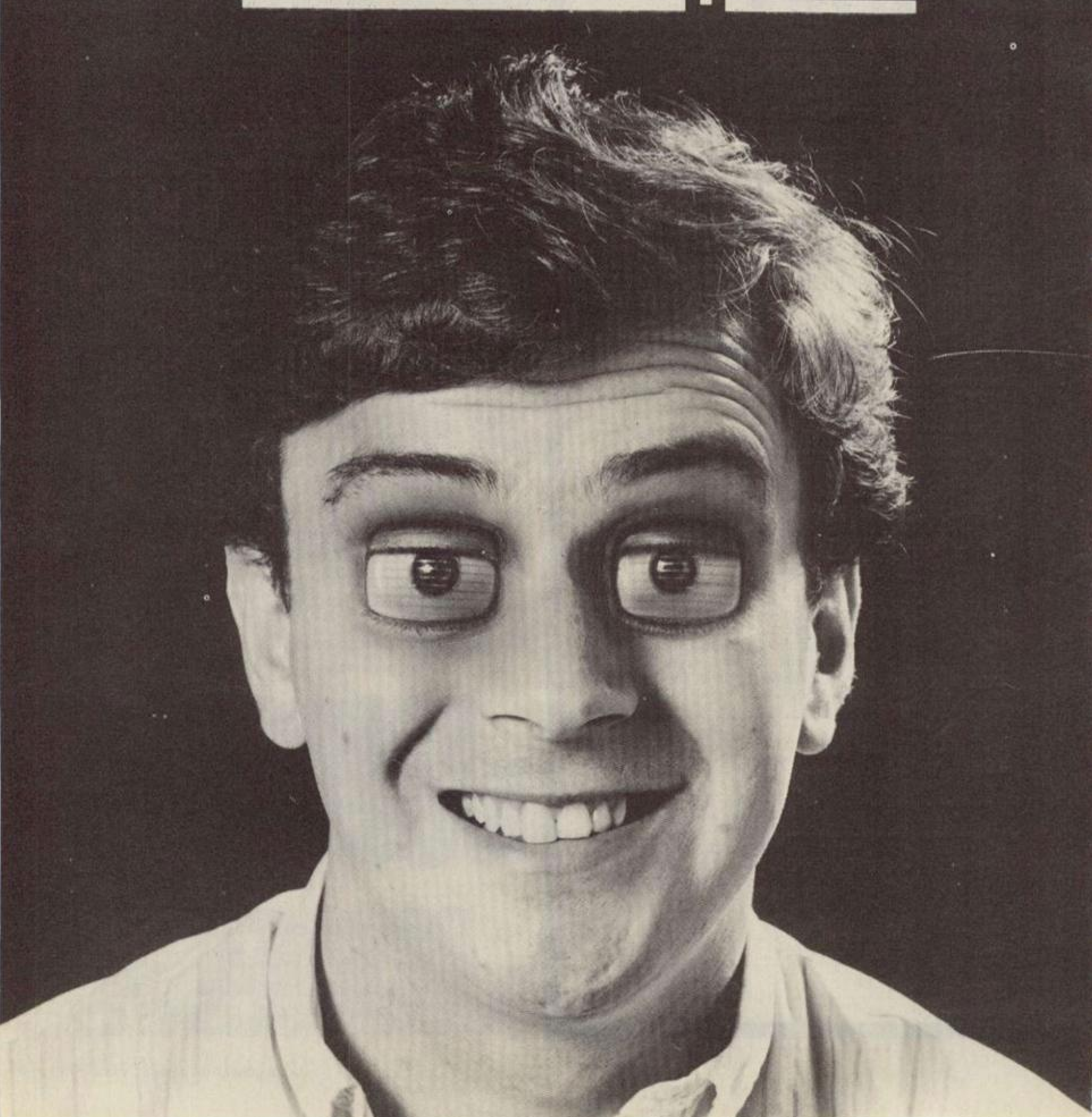
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Where will you find an exhibition hall with so much parking space — and in parkland too?

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The big show for a quid (or less)!



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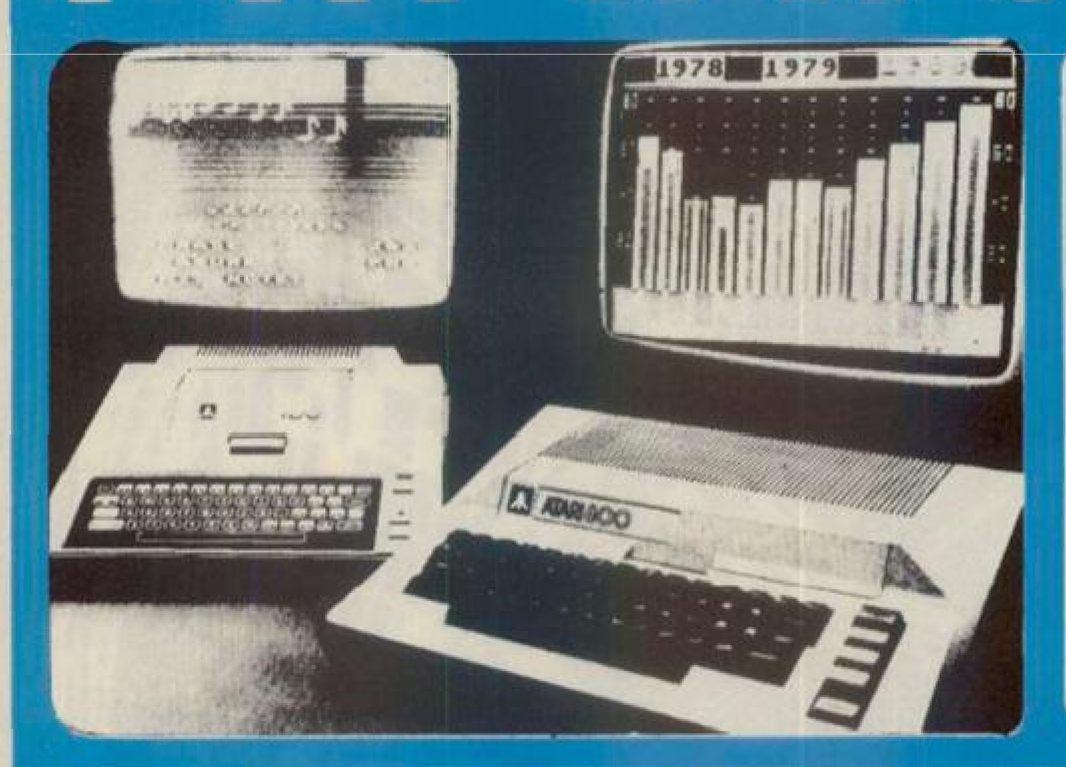


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I am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochures and test reports as well as your price list covering all of the available Hardware and Software:

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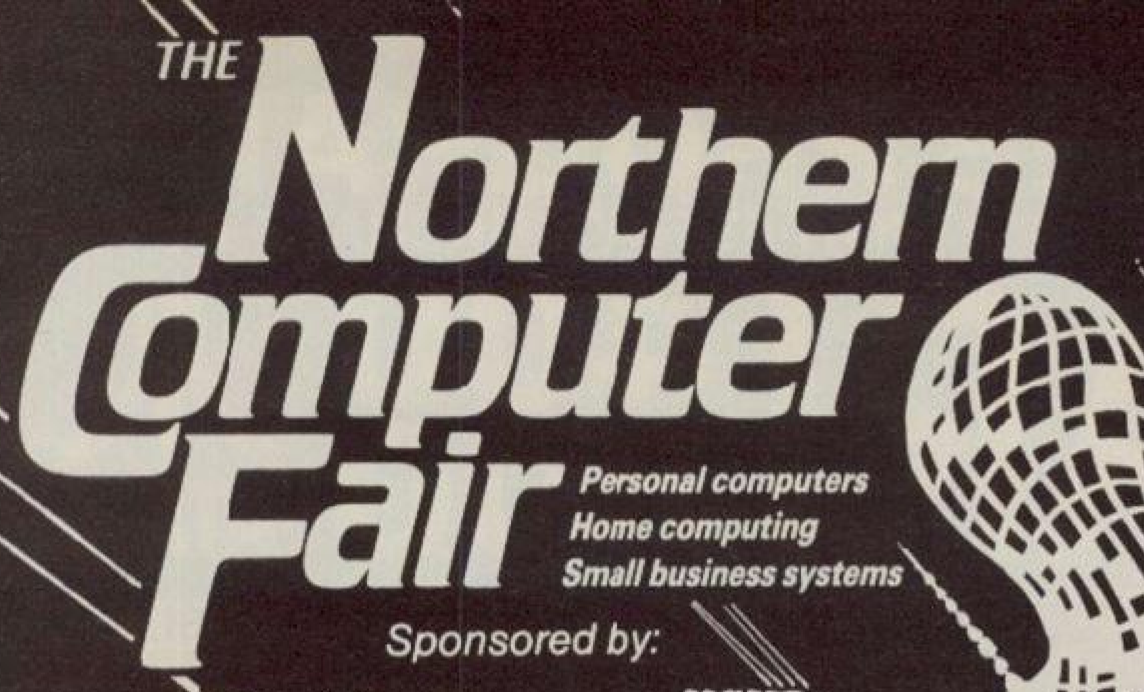
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Following the overwhelming success of the 1982 Northern Computer Fair, the sponsors announce that an even bigger and better show will be held again this year at Belle Vue, Manchester, from November 24th-26th.

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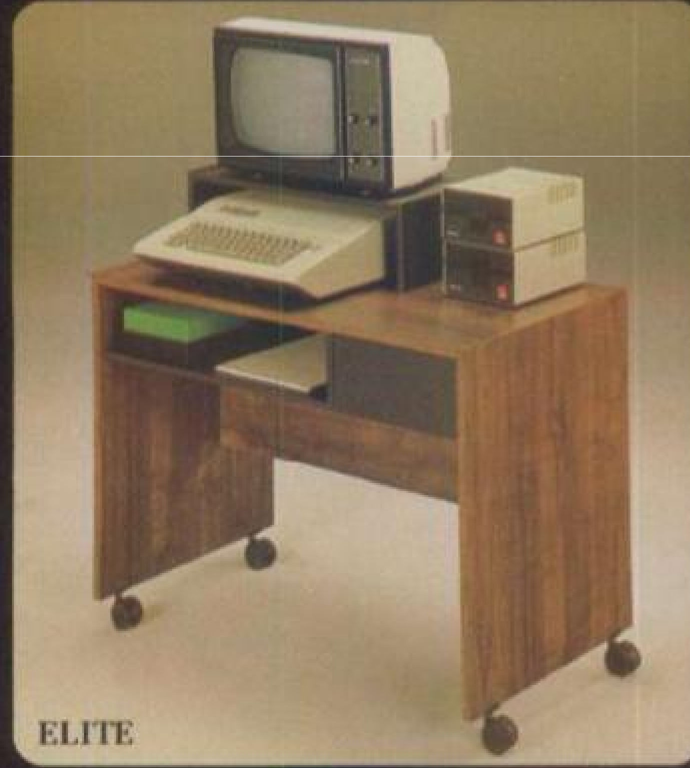
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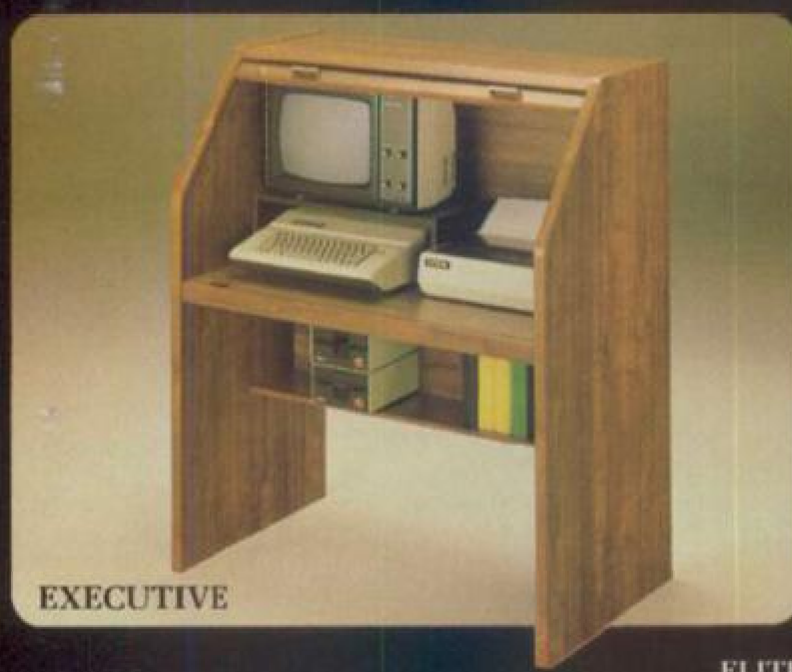


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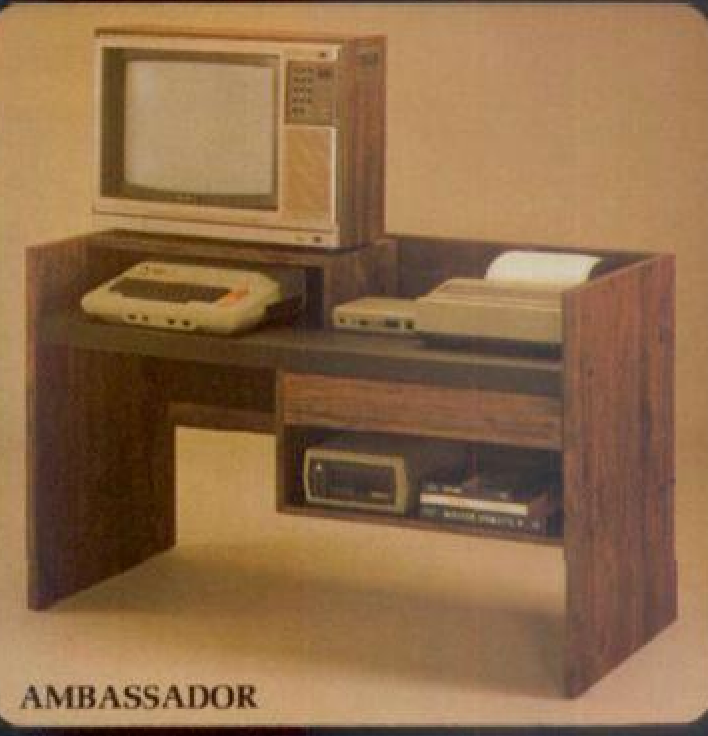
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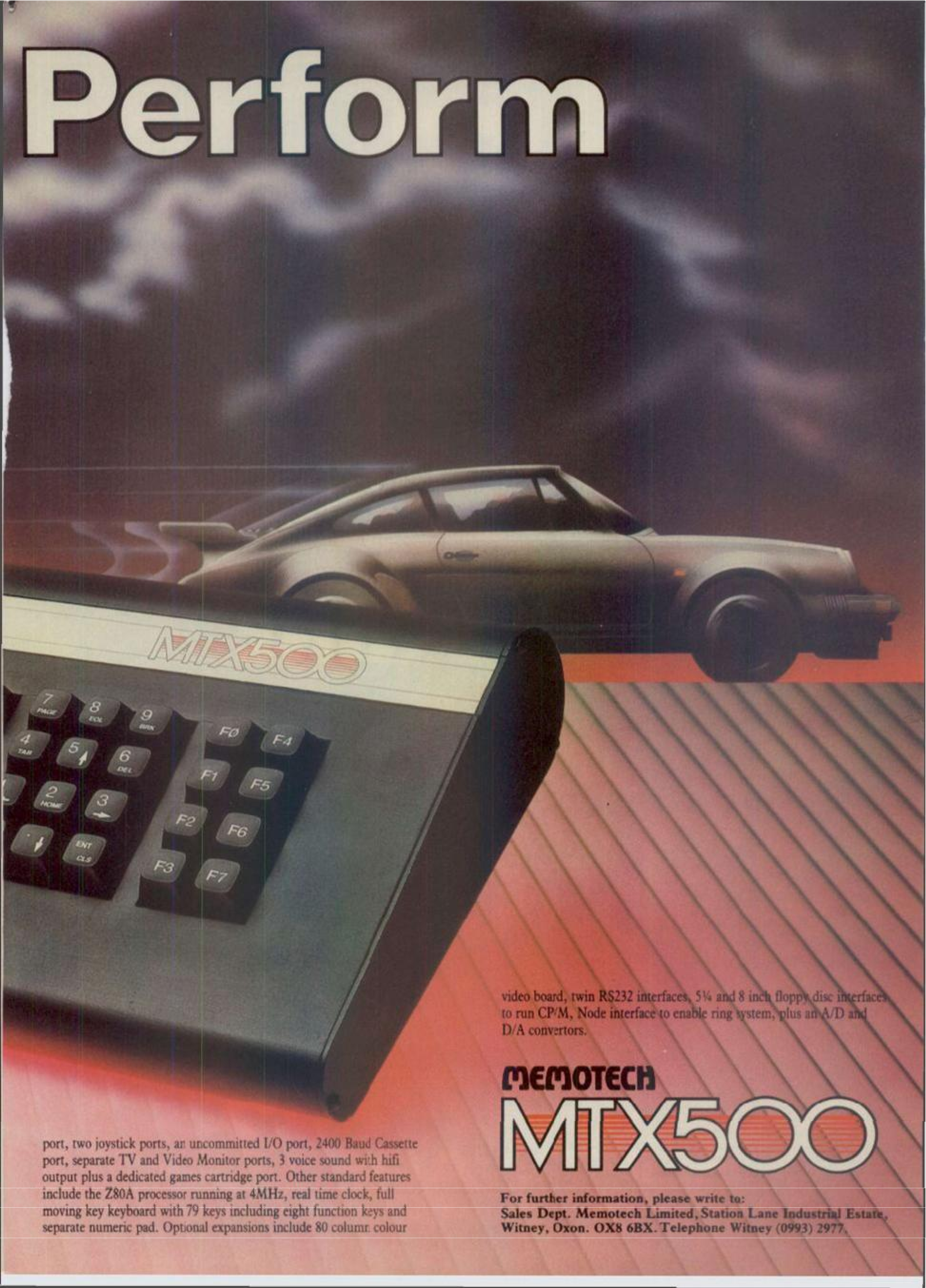
The MTX500 is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX500 is already capable or very easily adaptable to almost every application. Glance through the standard features below – you'll see what we mean.

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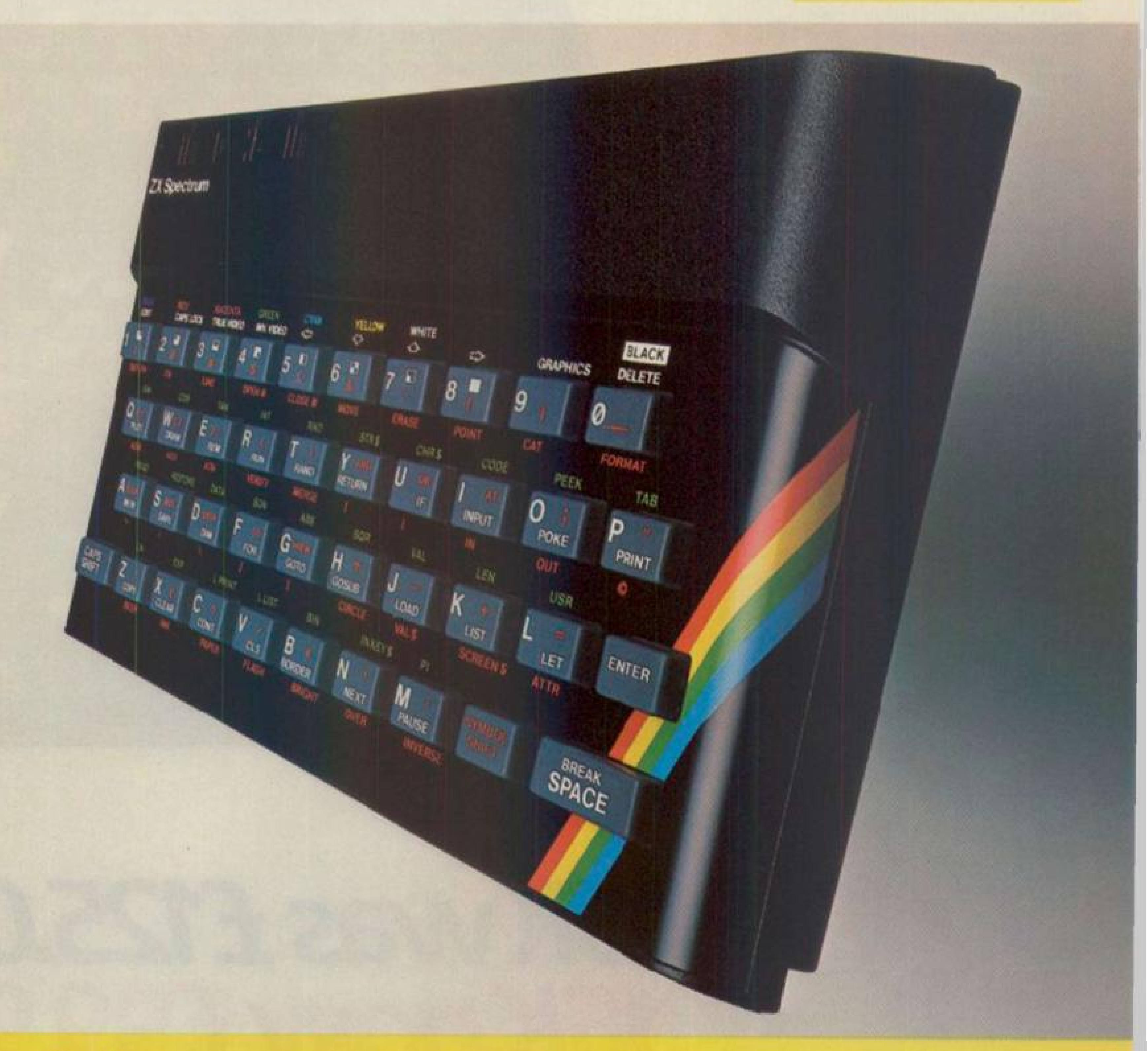
The MTX500's 16k ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, LOGO and NODDY. ROM routines include an ASSEMBLER/DISASSEMBLER with screen display of the Z80 CPU registers, memory and program which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to define sections of the screen to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

Hardware

As standard – 32k of user RAM expandable to 512k plus 16k of dedicated video RAM. Sixteen colours, 40 column text, 256 × 192 high resolution graphics with all sixteen colours available and easily moveable user defined graphics (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer


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5
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2 HOME
3
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F4
F1
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F6
F3
F7
port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 3 voice sound with hifi output plus a dedicated games cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight function keys and separate numeric pad. Optional expansions include 80 column colour
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MTX500
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sinclair special 1



Inside...
Latest prices round-up...
Latest software...
Order form...

Introduction

One thing's certain about the Sinclair world – there's never a dull moment.

Every month sees new software and new hardware, produced by Sinclair enthusiasts, or produced by Sinclair itself.

The magazines do a fantastic job of keeping you up to date with the input of enthusiasts. We want to keep you in touch with Sinclair's own developments.

Every month, there'll be a Sinclair Special in this magazine.

Sometimes, inevitably, there won't be anything new to say – we want to break away from the breathless announcements of hardware and software you just can't buy.

But when something new *is* available, we want you to have accurate information – fast. You'll find it here.

This month, we're giving you the latest information on the recommended retail prices of Sinclair equipment. They're *our* prices, and you may well find things cheaper (or dearer) in the shops. If they're cheaper – terrific! Snap them up. Note, however, that from us the ZX81 is down to £39.95.

We're also announcing six superb new Sinclair cassettes for the Spectrum, and three more which make full use of the ZX81. There's an order form at the back of this Special.

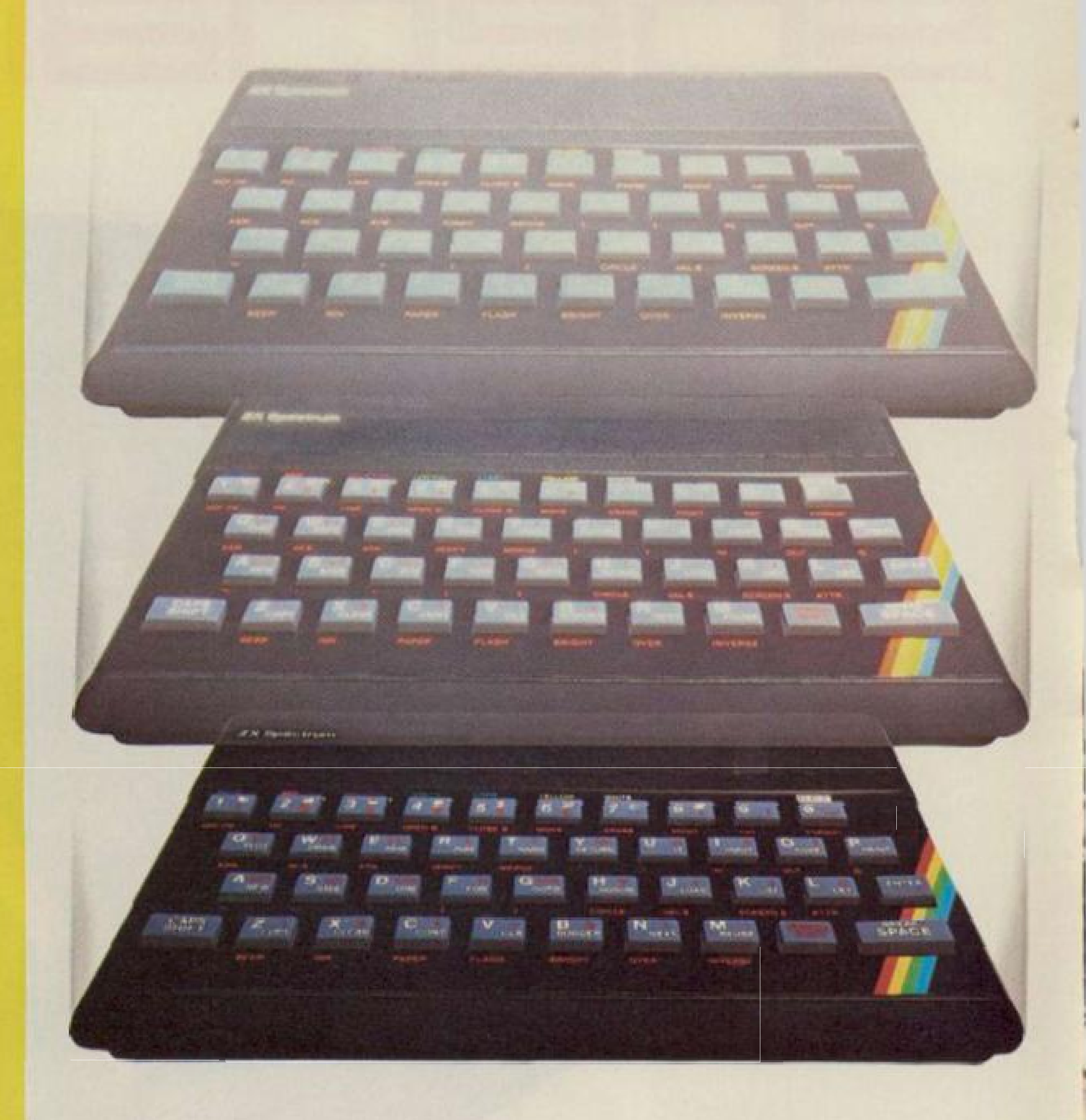
Next month... but there, next month is another story! Watch (as they say) this space.

Nigel Searle

Nigel Searle.
Managing Director,
Sinclair Research Ltd.



Spectrum – latest recommended retail prices.



16K was £125.00

16K now £99.95

48K was £175.00

48K now £129.95

ZX Printer was £59.95 — *ZX Printer now £39.95*

ZX81 was £49.95 — *ZX81 now £39.95*



Six new ways to make more of your Spectrum.

Take a look at these brand-new titles. Each is an outstanding new program using the full potential of the Spectrum, for games with stunningly animated graphics, for strategies of fiendish cunning, for masterly applications of computing capability…

Cyrus-IS-Chess Based on the Cyrus Program, which won the 2nd European Microcomputer Chess Championship *and* trounced the previously unbeaten Cray Blitz machine. With 8 playing levels, cursor piece-movement, replay and 'take-back' facilities, plus two-player option. The 48K version has many additional features including an extensive library of chess openings. For 16K or 48K RAM Spectrum.

Horace and the Spiders Make your way with Horace to the House of Spiders, armed only with a limited supply of anti-spider-bite serum. In the house, destroy the webs before the spiders can repair them. Then destroy the spiders, before *they* destroy Horace! Undoubtedly the creepiest Horace program ever produced! For 16K or 48K RAM Spectrum.

Computer Scrabble The famous board game, on-screen – with the whole board on view! A huge vocabulary of over 11,000 words. Full-size letter tiles, four skill levels – the highest of which is virtually unbeatable. For 1 to 4 players. For 48K RAM Spectrum.
(SCRABBLE trademark and copyright licensed by Scrabble Schutzrechte und Handels GmbH – a J.W. Spear and Sons PLC subsidiary.)

Backgammon A fast, exciting program, with traditional board display, rolling dice and doubling cube. Four skill levels. For experts – or beginners. (Rules are included – it's the quickest way to learn the game.) For 16K or 48K RAM Spectrum.

FORTH Learn a new programming language, as simple as BASIC, but with the speed of machine code. Complete with Editor and User manual. For 48K RAM Spectrum.

Small Business Accounts Speeds and simplifies accounting work, produces Balance Sheets, Profit and Loss information *and* VAT returns. Complete with User manual. For 48K RAM Spectrum.

Overleaf–your Sinclair order form.

Three new ways to get the best out of your ZX81.

The range of Sinclair software for the ZX81 continues to grow.

These three new cassettes offer two totally different challenges to you and your ZX81. The games – like so many ZX81 games today – really do use the ZX81's capability. The FORTH program is a fascinating extension of your own computer understanding.

Sabotage Defender or attacker? The choice is yours in this exciting game.

Be the Guard and defend the randomly placed boxes of ammunition inside the compound – or be the Sabateur and attack the ammunition!

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

City Patrol You are the Commander of a laser-firing ship. Your task is to intercept and destroy alien suicide ships descending on your city. Judge your rating as Commander by how many aliens you destroy and how much of your city survives.

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

FORTH Discover a new programming language which combines the simplicity of BASIC with the speed of machine code.

FORTH's compiled code occupies less than a quarter of the equivalent BASIC program and runs ten times as fast. It is fully extendable by the addition of user-defined commands.

Free User-Manual and Editor Manual with each cassette.

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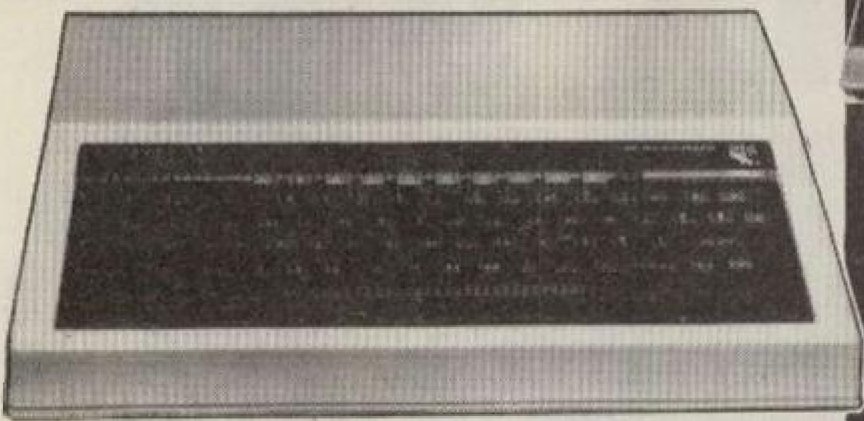
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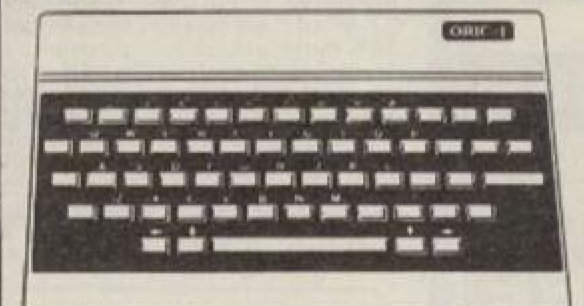
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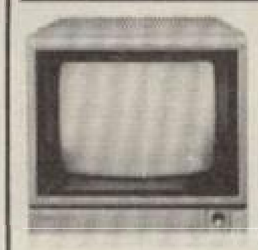
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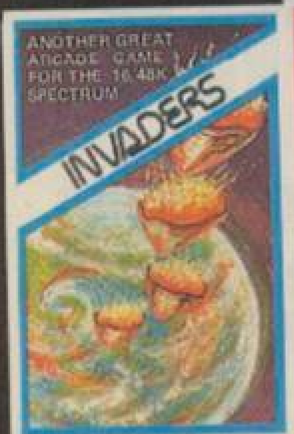
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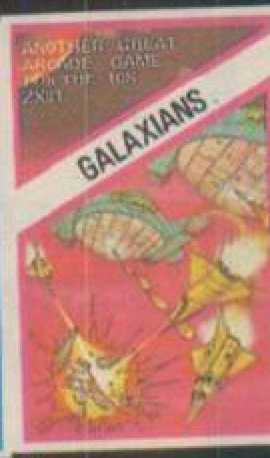
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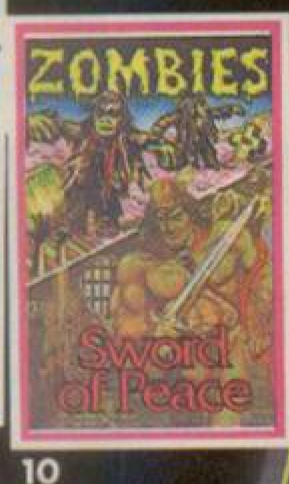
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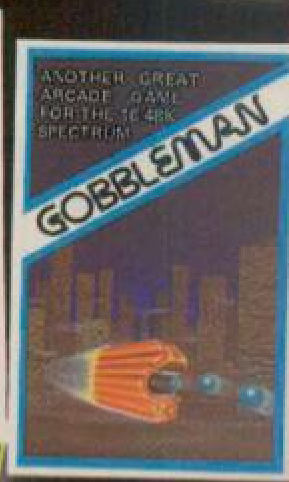
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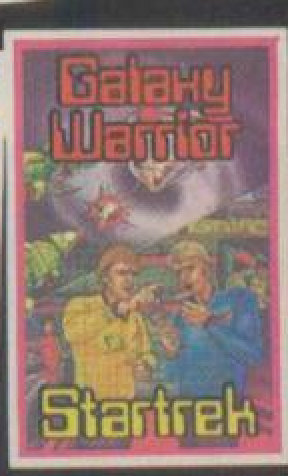
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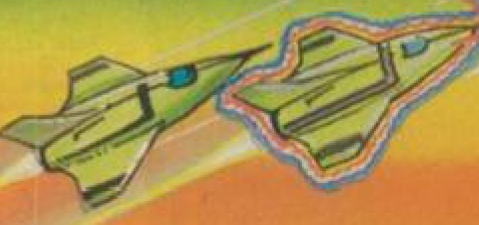


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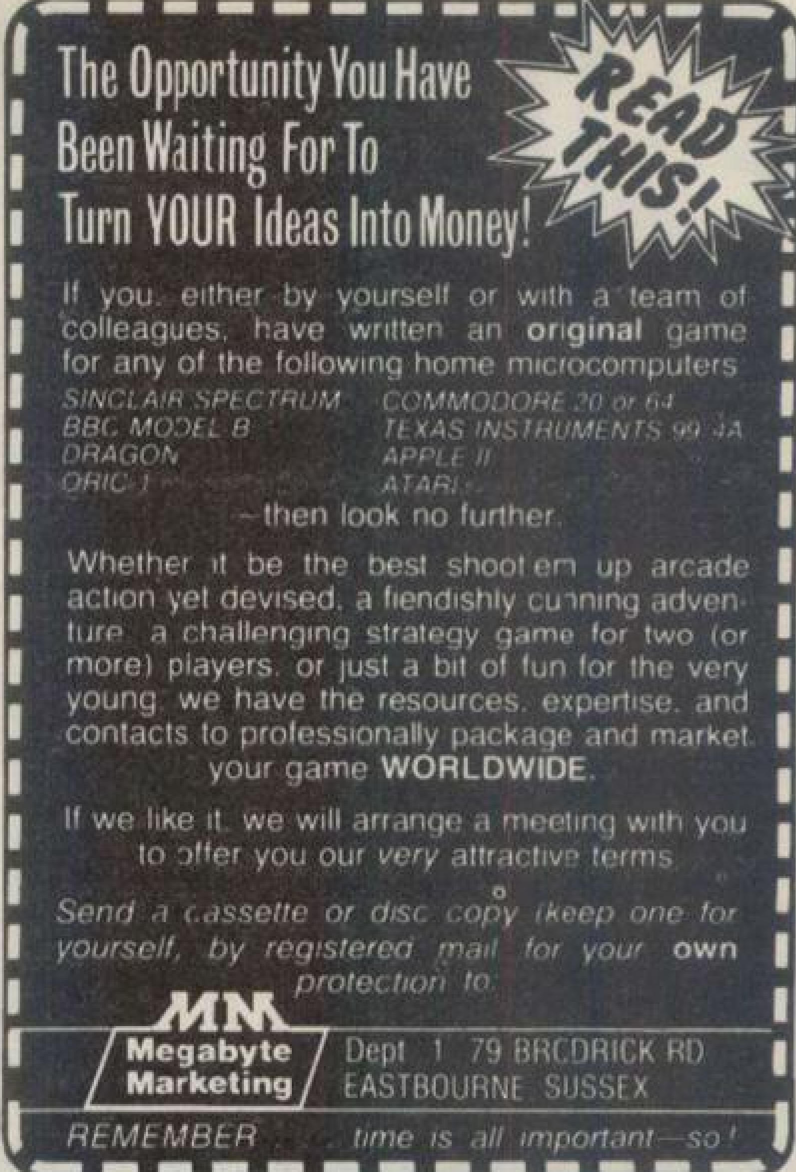
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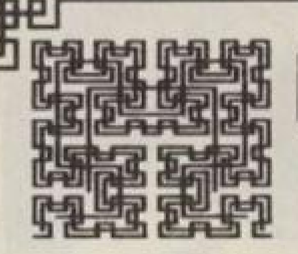
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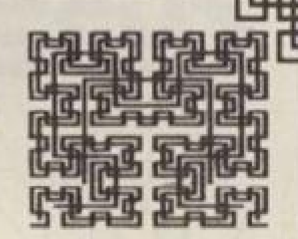


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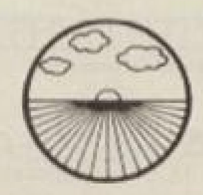
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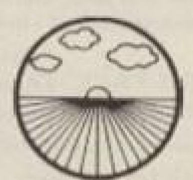
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**and others*

PARFIT GENTIL KNIGHT

Here is my reaction to your May editorial: Sir Clive won't be starving this Christmas.

I am sure I speak for many home computer users when I say how outraged I am when I hear the money difference between the cost of the machine and the actual shop price.

I lately heard that the Spectrum cost £15.00 to make. Please tell Sir Clive that if £15.00 is subtracted from £99.95 you do not get zero.



We hear excuses that the market can only take so much, but surely it is in the consumers' and, as is so painfully obvious, makers' interest to have their products as low-priced as possible. Surely it makes sense — the lower the price, the more you sell. If Sinclair was really trying to bring home computing to everyone's fingertips, then he would bring down the price. I end with a call to Mr Millionaire Sinclair — cut Spectrum prices now!

John M Thorne, Slough, Buckinghamshire.

SNAKE LETTER

The June issue of *Your Computer* contained my article on Snakes and Ladders. The program was written for a BBC with a 0.1 OS. Parts of it will not work properly if you have a 1.2 OS. Some modifications need to be made.

Scan through the program putting VDU4 and VDU5 either side of any Printtab statements. Put VDU4 just before Printtab and VDU5 after the first colon after the Printtab statement. For example, on line 1000, put

:VDU4

after

PROCL(29)

and

VDU5:

before

PROCANS

Also change line 190 so the last character on the line becomes a 0 rather than a 7. Do the same to line 880.

Peter Donn, Upminster, Essex.

USER FRIENDLY

Congratulations to Mr Taylor for his most useful and effective ZX-81 quick-load program in June *Your Computer*. Loading programs in this way is unfortunately none too user-friendly, what with swapping tapes and using machine-code calls, especially if the programs are to be used by other people.

This can be overcome in the following manner. When the program to be saved is in the computer and the quick-load code entered at line 0, then Save and Verify it as described in the article. Remove this tape and mark it — or confusion will ensue — and replace it with a taped version of the quick-load machine code. Load this into the computer and add the lines:

```
1 Save "name"
2 RAND USR 16607
```

Find a clean tape onto which the final recording is to be made, start recording and Run the program. Watch the screen and immediately the diagonal "searching for program" line appears turn off the recorder and then press Break. Remove and mark this tape: do not rewind or forward it. Put the tape containing the main program back in, rewind and load at high speed using

RAND USR 16607

Now go back to the other tape and save this program at high speed by typing

RAND USR 16514

without

NEWLINE

start recording and immediately Newline. This should be done from within the program if Autorun is required.

Thereafter when you want to load the program, rewind and Load "name". Note that this effectively restores the ability to Load by name. The quick-load program then loads at slow speed and autoruns, loading at high speed the most program on the tape, that is, the main program.

Using Verify requires a little more effort as the start of the main program must be found first, either using the tape counter or using

LOAD "X"

where X is not the program name and then watching for the end of the quick-load program on the screen.

This method of saving does sound rather contorted, but in fact is very quick and easy to do and saves a lot of trouble when loading programs at a later date.

It is not true, as it is stated in the article, that machine code in Rems cannot be accepted by quick load. It will, however, be necessary to change a Rem at line 1 to line 2 using Edit before adding the quick-load Rem statement, and calls to machine code must be addressed 262 bytes further on, for example, a call to a line 1 Rem will now be Rand USR 16776.

Line 30 in listing 4 should read "20 POKE 32512+A,PEEK (16514+A).

W Sturges, Lancaster.

CHARACTER SET

I feel I should point out an error in Tim Langdell's article in the June issue of *Your Computer*, about the Oric and Spectrum Graphics.

Mr Langdell is perfectly correct when he says that the Oric has two completely re-definable character sets, but the actual number of characters is only 176, not 512, about one third of the number which he suggests. This is mainly because the character sets are only 128 characters long, the most significant bit of the code on the screen being used as an indication of whether the character should be displayed in normal or inverted colours, so that the code left for determining the character is only seven bits long.

Using the eighth bit to invert the colour in which the character is displayed means that up to four colours may be displayed at one time using only one foreground and one background colour-defining attribute.

These colour-defining attributes and the other codes which flash text, etc, also reduce the number of characters in the character sets as they have to have codes too, in fact, they use the first 32 codes in both character sets.

There is yet a further complication; as this would mean that each character set should contain 96 characters, that is 32-127, but the second only contains 80. The second or alternate character set, which contains a lop-sided version of teletext graphics, overlaps the screen memory by 128 bytes — 16 characters — and although the mechanism exists to display these characters they only appear as random sets of dots because the machine defines them with the same bit of RAM which it uses for the first five and an eighth lines of the screen — in both Text and hi-res modes.

Thus, in practice, there are only 176 character definitions held in RAM: codes 32-127 in the first set and 32-111 in the second.

A J Edgington, Norwich, Norfolk.

BUGBLATTER FOR THE ATARI

Perhaps David Andrew — Letters, June *Your Computer* — has found bugs in assembler routines, but there are very few bugs in Atari Basic. Most are in the operating system. Here are all the ones I have found or read about.

The printer and cassette use the same buffer IOCB# 7 — see page 23 of the manual. If this is not clear it sometimes spoils a Csave, so you can not Cload your program. The solution is to do an LPrint before each Csave. If you do not have a printer, this just produces a harmless error message, but it does clear the buffer.

Basic sometimes hangs during program editing. I do not know why, and I do not know of a cure. You just have to Save things often. It has only happened to me a couple of times in nearly two years. This bug has apparently been fixed in the Revision B operating system now used in the U.S.A., but all U.K. machines use Revision A, and will never be supplied with Revision B. According to Compute!'s book *Mapping the Atari*, Peek (58383) is supposed to give 56 for A and 0 for B. I do not get either number.

Using Input without an argument causes my 800 to lock up. Just type Input in direct mode and see.

Trying to enter lines longer than three screen lines causes problems as the screen editor gives the overflow to Basic as the next line.

The unary minus of zero, that is Print -0, prints garbage. If you want to print an X that is likely to be -0 then use Print 0-X. Print 0-0 works just fine.

You can use reserved words as variable names. The catch is, you cannot do it with words that start with Not. Using Note as a musical variable with Chord can turn out as Not E.

Another cassette file problem: you cannot write a file smaller than 128 bytes to cassette then turn off the cassette motor without producing garbage. Then if you read back more than 128 bytes, the Atari uses the bottom part of Page 6 to RAM. It was apparently designed that way. Solution: output a dummy file of 128 bytes of blanks before your data, then throw it away on Input. Solution to Page 6 problem: do not use 0600 to 067F for machine language routines.

Also, you can Dimension arrays to be larger than memory without getting an error message. I am not sure if this is a bug or a feature. Any other offers?

Jack Schofield, London W3.

ROTATOR

Although the 16K version of the Spectrum 3D rotator in the July issue is error-free, the 48K version needs a few corrections. In the conversion table for the hex dump 7B should be changed to F8 and not 7C as given. In the Basic program 31721 and 63729 in lines 2060 and 4020 should read 63465 and 63279 respectively.

It is not necessary to use the hex loader provided — any loader will do — but you must run lines 100-150 to create the Sine table. Remember also to set the variable Addr using the Pokes on page 82.

L. Schendler,
Bayswater,
London.

ORIC PICTURES

With reference to the article on Oric graphics in the June 1983 issue of *Your Computer*, the illustrated programs and the paragraph headed "Speed and smoothness" may be giving some less experienced users some confusion. First of all line 200 in the program Oric 2 is strange. I presume that the line should read

```
200 INK 1
```

which would turn on red characters. The program for the Spectrum with which this is compared omits this step.

It is entirely feasible to get high-resolution movement on the Oric using the Char command. I think this is what the writer was after. The following is a short program that gives smooth horizontal movement:

```
10 HIRES
20 FOR N = 1 to 230
30 CURSET N, 100, 0
40 CHAR 62, 0, 1
50 CURMOV -1, 0, 0
60 CHAR 62, 0, 0
70 NEXT
```

A similar technique will give vertical movement. The movement is quite slow — but steady — at this resolution. The screen is crossed in about 12 seconds. Using a Step in Line 20 and a few other alterations the movement can be made more coarse and faster.

David Sinfield,
Heacham,
Norfolk.

HOTH STUFF

Unfortunately, I left out the vital key instructions in the Star Wars Battle on Hoth game published in the July issue of *Your Computer*. they are as follows:

I to Q	— fire
Q to P	— increase rate of climb
A to Enter	— decrease rate of climb
Shift to Space	— turn around
Shift to V	— turn left
B to space	— turn right

Also, you should insert Poke A,B, after Print A,B in the machine code and character set loaders.

Duncan Kinnaird,
Glinton,
Peterborough.

EDITORIAL

TENSE, NERVOUS, IRRITABLE every time you use your micro? You could be suffering from bad computer design. It is a malaise that is on the increase as more and more computers are rushed on to the market with apparently less and less time spent on details.

Fortunately it is never fatal and rarely worse than the infamous ZX-81 RAMpack wobble — the nastiest outbreak of recent years which left emotional scars on a whole generation of computer enthusiasts.

Poor design takes two forms: badly-conceived ideas, and well-conceived ideas badly executed. The plug on the new Comx 35 is a badly-conceived idea. You have to take your pick between not running your micro because you have not plugged it in and not running it because you have. The generously-wide Comx plug ensures that the on switch at the wall socket is always off.

The Oric's reset button is a well-conceived idea badly executed — or rather badly located. To reset, the energetic Oric owner has to flip the machine over and drive something long and thin such as a pencil into a small hole. In practice it is much easier to turn the micro off and then on again at the wall — an option not open to the Comx user.

Sometimes it is a little difficult to decide into which of the two categories a particular shortcoming falls. But there is always a difference between bad design and a manufacturer building down to a price.

At the moment you cannot expect a micro which costs less than £100 to have a proper keyboard. In most cases it is a feature that the machine's maker had to choose to keep the price as low as possible. It could only be counted as bad design if, say, the keys were to stick down in use.

Poor keyboard design initially attracts more criticism than anything else. As the user's interface with the computer a keyboard's failings are more conspicuous and invariably the first to be discovered — even though they may be minor compared with any sins the designer may have committed in the privacy of the micro's inner workings.

The Spectrum's lack of full-sized space-bar, reset button and uncomfortable angle preoccupy its critics. Some even object to what they see as its excessive use of keywords which are supposed to make typing commands simpler. The high degree of coordination needed to type Ink on the Spectrum involves four key-strokes as opposed to three on the more conventional Oric.

No keyboard feedback is also cited as a problem. Even if the Oric's beep is ear-piercing at least you know you have made contact with a key. But real keyboards do not escape scot-free. Those new to the Dragon may find that a carefully entered program can be made to dematerialise at the touch of the clear button position next to Return.

A good deal of what is seen as bad design may be the result of major manufacturing decisions — unusual choice of CPU, or deciding that interfaces would push the price too high. But so much could be corrected very easily: lack of scrolling on the Lynx, the ZX-81 overheating, the Spectrum's short video leads.

A few pennies or a few more hours of careful thought spent at the design stage could stop millions of us being driven mad by trivial faults.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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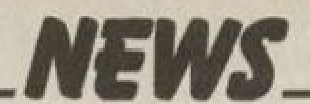
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Editorial: 01-661 3144
Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Subscriptions: U.K. £9 for 12 issues.

Printed in Great Britain for the proprietors Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG. ISSN 0263-0885. Printed by Riverside Press Ltd, Whitstable, Kent, and typeset by Instep Ltd, London EC1.

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Pete Shelley

From punk to programming

FIRST the software industry started to behave like the music business, fancy packaging, star programmers and the like. Then the record companies, like Virgin, K-tel and EMI started to sell programs.

Now with a wave of pop stars who think they are programmers, and vice versa the borderline between the two industries has broken down.

Seventies pop star Steve Hillage now writes musical effects for Virgin's games for the Spectrum. Meanwhile new wave hero and former Buzzcocks lead singer Pete Shelley whose first single Spiral Scratch spent a million punks pogoing into the streets in 1977 is now a Spectrum enthusiast.

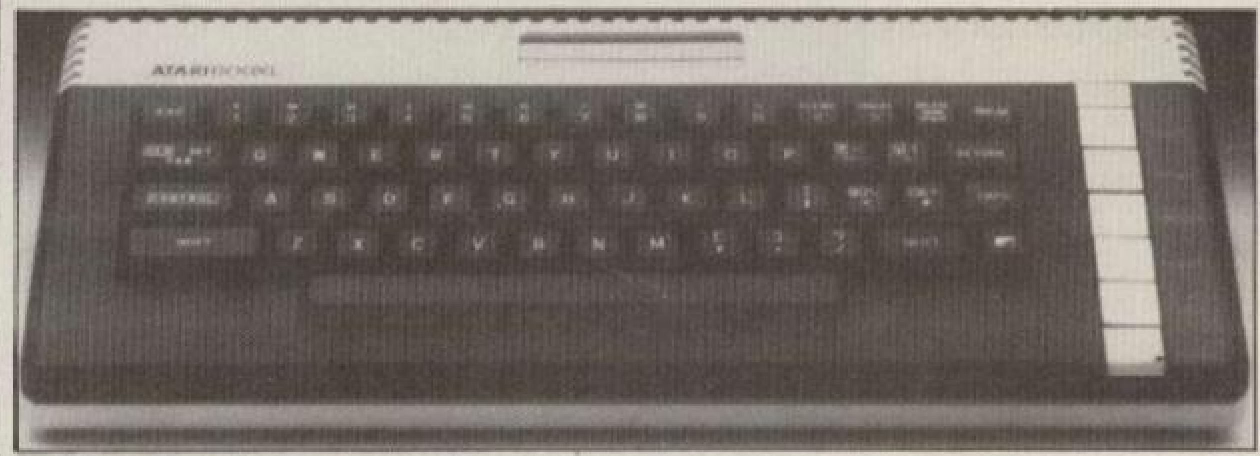
His current top-30 album XL-1 includes a track for the 48K Spectrum which allows you to display the lyrics for the songs on screen. A trap prevents you playing the track by accident at full blast over a hi-fi system.

You have to specifically lift the arm onto the Spectrum track which you then transfer to tape before loading the machine code with Load""Code. This technique was pioneered by *Your Computer* in June 1982 with a give-away flexidisc featuring an Othello game for the ZX-81. We repeated the idea in December 1982 with games for the ZX-81, Spectrum and Vic-20, all on a flexidisc.

Then in May of this year EMI released a single by Chris Sievey called Camouflage which was available on record or cassette and which had a track for the ZX-81 which displayed lyrics and simple graphics as well as a game.

Pete Shelley's album was released in June after he and a programmer called Joey had spent five months experimenting with ideas for using a Spectrum display to match his music.

Atari unleashes 600 XL, 800XL, and video game upgrade kit



DESPITE MASSIVE advertising and great games cartridges Atari has never sold many micros in Britain. The brash American styling of the home computer range, the tacky keyboard of the 400 and general overpricing have all helped to dissuade British buyers.

Now Atari is launching a massive Autumn offensive on two fronts in Britain. The number of new machines is staggering — two home computers, a computer upgrade for the games machine, three printers and a host of peripherals. At the same time Atari is converting its software to run on rival machines, the Spectrum, Vic-20 and Commodore 64 amongst others.

The two new computers, 600XL and 800XL, both have typewriter-quality keyboards, are 6502-based and will run all the old Atari computer software. They both use a 24K ROM including Atari Basic which has particularly good graphics and sound commands. Sound allows you to control four voices through a 3½ octave range. The 62 keys include 29 graphics keys, four function keys, and a Help! key in case you panic. The 600XL and 800XL are essentially up-dates of the 400 and 800 in smart new cases. The 600XL has 16K RAM and the 800XL has 64K. Both should go on sale in September.

Above: Atari's new 600 XL.
Below: the Graduate which turns a game machine into a computer.



The Graduate is Atari's catchy name for the video games machine upgrade which will turn the VCS 1200 into a computer. The new printers range from a cheap four colour printer, the 1020 on the lines of the Sharp design which has been adopted by Tandy and Oric amongst others, to the better quality 1020 printer.

On the software side Atari is making Pac-Man, Centipede and Defender available on the Texas TI-99/4, Vic-20, and Commodore 64. More titles will soon follow and will also be converted for the Spectrum.

Microsoft sets standard for clone computers to run same games

IF MICROSOFT has its way you will soon be able to run the same software on a range of different new machines.

The American company has proposed that manufacturers adopt its MSX standard for 8-bit machines in the games-orientated market. MSX prescribes that all machines should include the same essential set of hardware and software features — a Z-80 processor, a TI9918 video display processor, input/output ports, joystick, ROM cartridge and cassette interfaces, and Microsoft's own 32K extended Basic interpreter.

So far the MSX standard has been endorsed by 14 Japanese computer firms including NEC and Sony, and one American company Spectravideo. Microsoft is now trying to interest British companies.

Obviously widespread acceptance of the standard would create an enormous mass market for games producers but Microsoft's proposals might be too late for the home market. For instance Nigel Searle Sinclair's managing director believes that standardisation may have to wait for the next generation of home computers perhaps based on 16-bit or even 32-bit processors.

Microtech will sell MSX backers Spectravideo's £300 80-K SV-328 and £200 32K SV-318 in Britain soon.



Arcade robots and software

ANOTHER LEADING arcade game manufacturer, Atlas Coin, is planning to move into the home computer market with a talking robot and a range of games for the most popular micros. Atlasoft will concentrate on retailing cassettes in record and video stores while a sophisticated micro robot is scheduled for release in November. It will be equipped with a speech synthesiser and will respond to spoken commands.

Warning — home micros could cause Third World War to erupt

WARGAMES is a new movie featuring a young computernik who accidentally links his home micro into the United States Defense Department's wargames computer — JOSHUA — causing the world to teeter on the brink of nuclear holocaust.

Improbable? Maybe. But when you consider that teenagers at one Manhattan high school reportedly succeeded in writing a program that allowed them to dial a Canadian computer network and take virtual control of a well-known soft drinks manufacturer's computer no great suspension of disbelief is required to make *Wargames* one of the most spectacular — but credible — films of 1983.

The central character — David Lightman, played by Mathew Broderick — is just an average American high-school kid in Seattle, Washington, except that he has developed the act of networking — not always legally — to a remarkable level of refinement.

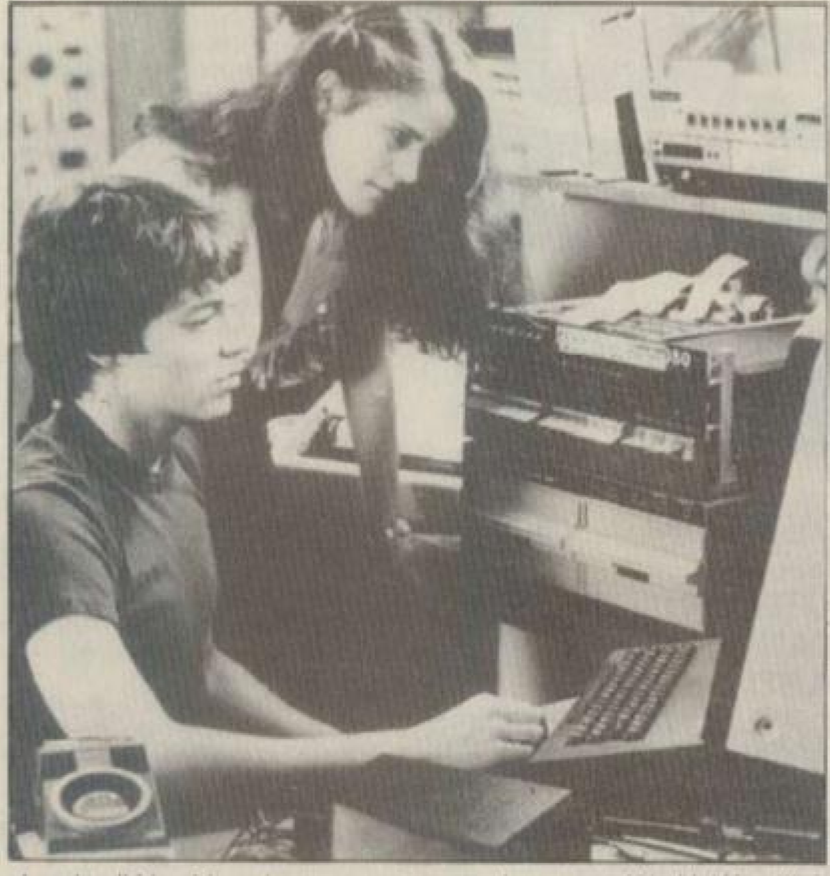
Like a radio ham, he can talk to other people like himself through vast computer communications networks. But there is a more interactive angle to his probing. He hi-jacks the software for new video games before they appear on the market, purely for his own amusement, of course. And by tapping into the high-school network he can boost his own grades.

He is hitch-hiking across the networks one day when he encounters an unidentified computer system. Under the impression that he is playing a harmless game he unwittingly challenges the government machine to a game of nuclear war — for real.

When the nickel finally drops, David cannot do anything about it. Both the USSR and the USA believe that an attempt to launch a pre-emptive nuclear strike is in progress against them. David is the only one who can stop the war, with a little help from disillusioned computer genius Professor Stephen Falken, played by John Wood.

Wargames is about getting in over one's head and Walter Parkes, who wrote the screenplay with Lawrence Lasker, is well aware of the danger of this. "Particularly in this area, where kids understand computers a lot better than their parents. There is a whole subculture of kids who like to break in to discover what the world is like — from their homes."

So be careful with that modem unless you want an SS-20 missile landing in the back yard.



A schoolkid with a homecomputer nearly causes World War III in Wargames. *Here he is altering a friend's school grades by computer.*

Chess champion ready to take on any rival Spectrum masters.

INTELLIGENT SOFTWARE is confident that its Cyrus Chess program is the strongest Spectrum chess program around — so confident, in fact, that it has issued a £5,000 challenge to other commercially-available chess programs for the Spectrum. The terms of the challenge are that the program should play six games with Cyrus under tournament conditions, for a £5,000 stake.

So far the offer has found no takers. One leading software company showed interest but withdrew when it discovered it would have to commit £5,000 of its own.

The challenge only holds for a month or two and only to programs which are presently available. As Intelligent Software's David Levy, himself a chess master, points out it would not be difficult to analyse Cyrus's game and design a program specifically to beat it.

Cyrus Chess is a past winner of the European Microcomputer Chess Championship. The chess-playing code takes up just 8K while the rest of the program is used to provide user-friendly features such as a demonstration option.

An Israeli company has developed an RS-232 interface for the Spectrum which will shortly be available in this country for around £50. The operational software is supplied on cassette and allows the user to select baud rates up t 19,200 baud. Details from CT Comptrade, Tel-Aviv, Israel.



Oric printer special offer

HOW MUCH would you pay for a 48K computer, a four-colour printer, and all the leads you might need to connect them? Oric now offers the cheapest deal around — less than £270, following price cuts and a voucher offer. The 48K Oric has had £30 knocked off the price to bring it to £139.95. A free voucher with the Oric entitles you to a £40 discount on Oric's £159 Sharp style printer. After attempts to sell the 16K Oric for £125 failed the price is returning to £99.95. Two further peripherals for the Oric, a disc drive and a modem, are due to arrive in September.

Commodore 64 price cut

COMMODORE has substantially reduced the price of the CBM-64. Previously sold for £345 its new recommended retail price is £243 with some dealers preparing to sell it for around £200. Price reductions are expected to follow for the Commodore disc drive and printer making it possible to buy a complete system for around £600.

The company claims to have already sold 450,000 units in the USA where it can be picked up for as little as $199.

It may look like an intelligent vacuum cleaner but the Edinburgh Turtle has ready proved itself as a way of teaching young children the ideas of programming. Up till now there was only one thing wrong with it — the price. Now it has been cut from £400 to £190 with a special offer of £175 during the Summer holidays.




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YOUR COMPUTER TOP 20

Game	Company	Machine
Arcadia	Imagine	Vic-20
Black Crystal	Carnell Software	ZX-81
Centipede	Superior Software	BBC
Donkey King	Microdeal	Dragon
Flight Simulation	Psion	ZX-81
Flight Simulation	Psion	Spectrum
Jet-Pac	Ultimate	Spectrum
Matrix	Llamasoft	Vic-20
3D Monster Maze	J K Greye	ZX-81
Necro-mancer	Synapse	Atari
Penetrator	Melbourne House	Spectrum
Pimania	Autota	Spectrum
Q S Scramble	Quicksilva	ZX-81
Rocket Raid	Acornsoft	BBC
Snapper	Acornsoft	BBC
Space Raiders	Psion	ZX-81
Telewriter	Microdeal	Dragon
The King	Microdeal	Dragon
Transyl-vanian Tower	Richard Shepperd	Spectrum
Zaxxon	Datasoft	Atari

Zzoom is certainly the best arcade game Imagine has produced and is perhaps the most convincing shoot-em-up program yet written for the Spectrum. You have to shoot down waves of attacking planes as they bank and dive towards you. If you can clear four complete waves then you have to take on tanks and finally you have to fly over the ocean to face further hazards. Zzoom has a very different appeal from Molar Maul which was Zzoom author John Gibson's first program for Imagine but it should be even more successful.

Smile please for the Microdrive — watch for the ZX-83 out West.



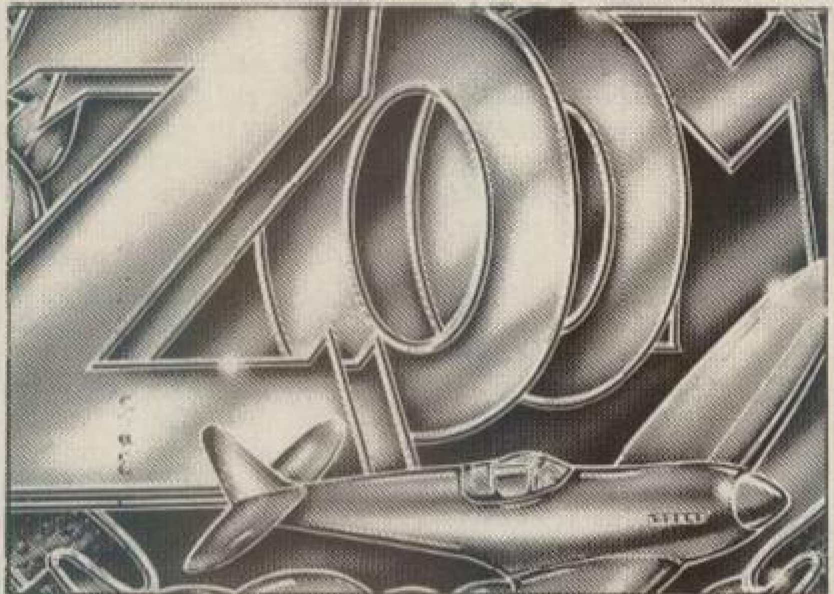
Plenty to smile about, now that the Microdrive is working. Sinclair researchers discuss plans for a new technology center.

SINCLAIR is getting his skates on — already the letters are in the post to the first 1,000 people who bought Spectrums asking them if they want to buy the fabled Microdrive just 15 months after Clive announced it was "coming soon". Now with the launch of the Timex Sinclair 2000 in America this month ZX-83 fever is mounting — and the latest Timex Sinclair 2000 specification for the American market shows some interesting deviations from standard Spectrum design.

The much-vaunted stringy-floppy, otherwise known as the Microdrive made what would appear to have been a somewhat premature entrace into the spotlight at the Spectrum launch in April 1982, since then it has been waiting breathlessly in the wings for production problems to be resolved.

Each drive costs £40 for up to 100K memory storage; it will be unusable without the £30 ZX expansion module which contains a Microdrive controller, an RS-232 interface and provides facilities for local area networking. Meanwhile in the U.S.A. the Timex TS-2000 has several features which are expected to appear on the ZX-83. The keyboard is much better than the Spectrum — with a full size space bar. Sound too is much improved. The machine has a built-in loudspeaker with a range of 10 octaves and 130 semi-tones plus two industry-standard joy-stick ports.

The TS-2000 takes a leaf out of the books of other leading U.S. manufacturers like Texas and Commodore by including a mini-cartridge facility. Sinclair has already admitted that he is producing a cartridge adaptor for the Spectrum and his next machine will have a built-in cartridge socket.



The improved thermal printer which is used with the Timex versions of the ZX-81 and Spectrum in America will now be sold here as the Alphacom 32. It offers the same facilities as the Sinclair printer COPY, LLIST, LPRINT but prints on 4.5in. wide paper and at a rate of two lines per second. Its print quality is claimed to be superior to the ZX printer's while replacement rolls are cheaper at £1 each. The printer which plugs directly into the ZX-81 and Spectrum £99.95 inclusive of VAT, postage and packing. It is available in the shops or by mail order from Dean Electronics, Glendale Park, Fernbank Road, Asoct, Berkshire.

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

QUESTIONS

How do you save space?

"How can one devise ways of making the most economical use of memory"

MOST VERSIONS of Basic store keywords such as If or Goto in the same way — as one-byte codes, usually known as tokens. But the way in which variables, line numbers and floating point numbers are stored varies from machine to machine. If you understand how your Basic stores its program lines and variables you can often find more economical ways of doing things.

Sinclair Basic, in particular, uses a rather complicated method for storing floating point numbers and considerable space savings can sometimes be made by using character strings instead. For example, on the ZX-81, the line

```
10 LET X=4
```

consumes 15 bytes while the alternative

```
10 LET X=VAL "4"
```

only takes up 12 bytes.

Similarly, on the Spectrum, numeric variables consume less memory than numeric literals. If you are short of space it is a good idea to assign 0 and 1 to single letter variables at the beginning of the program and substitute these variables for the numbers 0 and 1 wherever they occur alone in the program. In a long program this technique can save several hundred bytes, at least. For example:

```
FOR n=L to L+L
```

where L=1 saves 7 bytes over

```
FOR n=1 to 2
```

These techniques are specific to Sinclair Basic but it is easy enough to discover how to exploit the quirks of other Basic interpreters. You can investigate how much memory a line consumes by using the memory-free function — FRE (0) on the Vic and Oric, MEM on the Dragon.

Dragon and Vic owners, for example, will discover that renumbering a program in steps of one reduces space substantially — low line numbers obviously consume less memory than high ones. But on the BBC line numbers both at the beginning of a line and after Gotos or Gosubs take up the same amount of memory whether they are large or small.

Yet another saving is to remove spaces between keywords. The Sinclair Basic interpreter does not register spaces although it inserts them in the screen listing. Other Basics, however, will allow almost all the text on a program line to be packed together.

Finally, you may find that you are not short of memory after all. Try running this two line program:

```
10 GOSUB 20
20 GOSUB 10
```

You should get an Out of memory message. The problem here is that when the interpreter performs a Gosub or a Proc instruction it stores the address it must return to on the Basic stack — in RAM. When the program returns from a subroutine the address is removed from the stack. If your program contains an endless loop of subroutine calls without returning you will find the stack gobbles up RAM very rapidly.



STORAGE

ALL COMPUTER SYSTEMS must use some form of storage device to hold programs and data. This storage may be internal memory or may be an external cassette deck or disc. The size of the memory is described by quoting the number of memory locations — bytes — present in K such as 16K, 32K or 64K. Random Access Memory, RAM, is always present and the most important point about this is that its contents can be easily changed.

It is therefore most useful for temporary storage of information by the user. The disadvantage of RAM is that it will only retain the information as long as the power is turned on. One solution to this problem is to use CMOS RAM chips which have only a low power requirement and can therefore be kept running with batteries when the mains power is off. At the other extreme is ROM, Read Only Memory, in which the contents of the memory locations are fixed.

These contents cannot be changed but they are not lost when the system is turned off, so that this type of storage is useful for containing operating systems and languages. In most computers the Basic interpreter is stored in ROM. In a position between RAM and ROM lies the EPROM, Erasable Programmable Read Only Memory, which will retain information on power down, but can be wiped clean by exposure to strong UV light and then the locations refilled. EPROMs are particularly useful for development work, as, if bugs are found they can be removed. The early versions of new computers therefore often use EPROMs instead of ROM.

They are also used when only small numbers of fixed memory chips are needed, such as for an add-on facility, as it is cheaper to program a few EPROMs than to make a small number of special ROM chips. The most common method of long-term storage in the home computer field is the cassette tape. The computer converts the contents of the memory locations to an audio tone which can be recorded on a domestic tape recorder.

There are two problems with this system, the first being that transfer of data must be relatively slow if the information is not to be corrupted. The rate of transfer is described by the baud rate, the higher the number the faster the transfer. The second problem is that if you want to find a particular piece of information you must search through the whole tape until you find it, as the information can only be searched in a serial fashion.

Floppy tape systems still use tape but are designed to a higher specification so that they can run at fast baud rates. This makes transfer quicker, although it is still serial. Floppy discs are more expensive but information is stored and retrieved very quickly, and access to the disc can be random, so that you can jump straight to the information you need.

On the simplest disc system there are 40 tracks on each disc, single density, but it is possible to double this with appropriate hardware and software to give double-density 80-track discs which can hold twice as much information.

STRUCTURE

A PROGRAM THAT is structured is easy to follow and logical. That is not strictly true as the flow has to be logical but there is no real reason why it should be easy to follow.

If you are intending to drive into the quagmire of structured programming try to use a structured programming language. Pascal and Algol are structured but now with the better versions of Basic you can have any language structured if you want it.

The feature that links these programming languages together is that they all allow the vigilant programmer to wage war on the Goto concept. Now, this may seem unfair to you, but look closely at how much damage the inoffensive Goto idea has done, and you should see what I mean. It is so tempting, and seems so powerful.

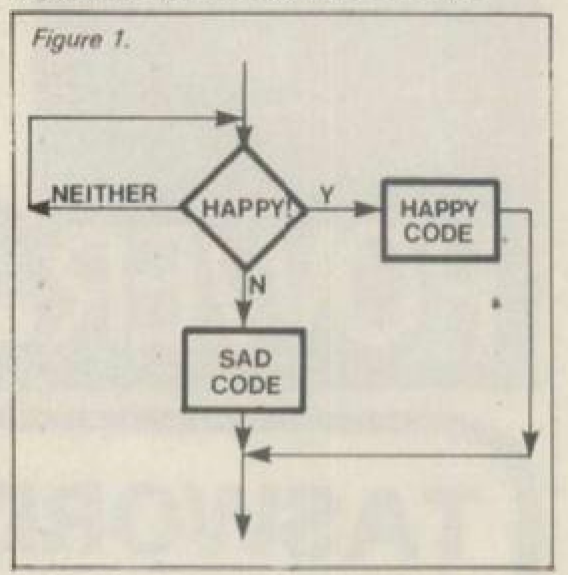
How does it all work though? Well, the key is that all structured programming languages tend to lend themselves to block structuring. Block structuring allows you to layout your program in the way you would if you were ever to write the structure down on paper. For example take the common problem of asking a question to which you expect the answer Y or N. Now you or I would just ask the question and take Y as a yes and anything else as an N, but imagine that we have been set the task of making the program foolproof. One way of tackling the problem is to have

```
100 INPUT "Are you happy (Y/N)?; A$
110 IF A$ = "Y" THEN 150
120 IF A$ = "N" THEN 200
130 PRINT "Try 'Y' or 'N'!"
140 GOTO 100
150 REM CODE FOR HAPPY
190 GOTO 300
200 REM CODE FOR SAD
290 REM END OF SAD
300 . . .
```

This may be simple enough, but when you look at the original problem, which was something like the flowchart shown in figure 1. the solution seems rather silly, especially when you look at the code given in structured Basic:

```
100 INPUT "ARE YOU HAPPY (Y/N)?"; A$
110 IF A$ = "Y" THEN PROCH
    ELSE IF A$ = "N" THEN PROCS
    ELSE PRINT "FOOLISH ANSWER, TRY
    (Y/N)" : GOTO 100
120 CONTINUE PROGRAM
```

ProcH is the happy code, ProcS the sad code, and in either case we end up at line 120 quite simply. I know what you are thinking "What's that Goto doing there?". Tricky. It is there because Basic relies on line numbers, and they eventually, are what you have to Goto.



Now, if you had Pascal, you could try this method:

```
REPEAT
Write ("ARE YOU HAPPY (Y/N);
INPUT A
UNTIL A = "Y" or A = "N";
IF A = "Y" THEN HAPPY ELSE SAD;
```

Here the most useful sort of interactive loop is shown — the repeat or While loop; they are exactly the same except that the test is at the bottom on one, and at the top on the other. All structured programming languages have one or both of these statements available. This example also shows Pascal's wonderful possibilities for procedure names, and being able to call them by name only.

Another statement that occurs in the more important structured programming lanaguages in the case statement. This enables you to select one of a series of choices by saying for instance:

```
CASE FEELING OF
Begin H: Happy;
      S: Sad
      A: Angry;
      M: Mad
END;
```

or print Case month of ("JAN", "FEB", "MAR", "DEC"); The implications of this are enormous, and can be extremely useful in the use of conversion routies, hashing tables and so on.

Piers Letcher

I could do that...

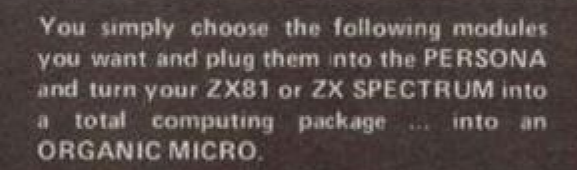
As you may know, all numbers are stored in computers as a string of zeroes and ones. 0001 is 1, 0010 is 2, 0011 is 3, and so on. Each digit from the right, represents steadily increasing powers of two, just as in ordinary numbers each digit represents a number of powers of ten: every time you give your computer an ordinary decimal number it first has to convert the number into binary, then store it ready for you to do what you will with it. Have you ever stopped to consider what the computer must have to do when you ask it to add two numbers? Let us assume that the two numbers are already held in binary, in two arrays, 16 binary digits long — use ordinary arrays, but do not input any digits other than 0s and 1s. Can you write a program in Basic that will add two binary arrays together? Remember to detect overflow and to handle carrys correctly.

The £15 prize for June's anagram problem goes to S. Wood, 12 Old Park Road, Palmers Green, London N13, who submitted the following program to run on a ZX Spectrum:

```
10 INPUT A$
20 FOR P=1 TO 6
30 FOR Q=1 TO 6
40 FOR R=1 TO 6
50 FOR S=1 TO 6
60 IF P=Q OR P=R OR P=S OR Q=R OR R=S THEN GOTO 140
70 B$=A$(P)+A$(Q)+A$(R)+A$(S)
80 B=0
90 FOR N=1 TO 4
100 IF B$(N)="A" OR B$(N)="E" OR B$(N) ="I" OR B$(N)="O" OR B$(N)="U" THEN LET B=B+1
110 NEXT N
120 IF B<1 OR B>3 THEN GOTO 140
130 PRINT B$,
140 NEXT S
150 NEXT R
160 NEXT Q
170 NEXT P
```

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Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.

NOTTINGHAM ROBOT

Whilst visiting the merry men of Nottingham computer club, Simon Beesley shakes hands with the future in the form of an Armdroid.

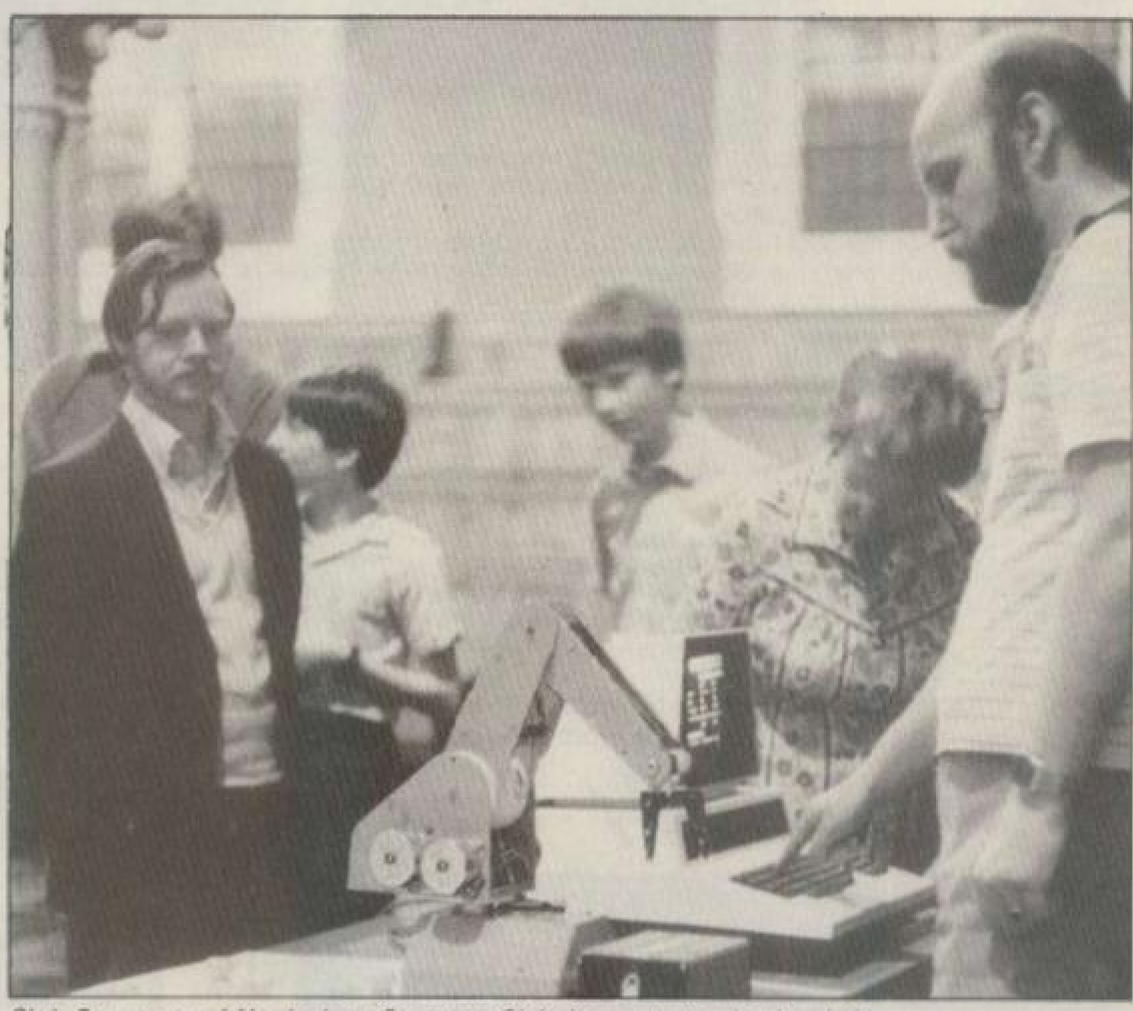
TALK TO THE members of any micro club and you begin to appreciate the enormous depth of computing expertise provided by the nation's computerniks. Britain, after all, has more home computer owners per capita than any other country in the world.

Nottingham Computer Club is a good example. Members' applications include writing educational software, games, programs for mining engineers, and robots. As clubs go it is quite venerable having been formed as long ago as 1979; but in the last two years membership has soared and now numbers 120.

One of its members, Chris Stevenson, built a robot arm, an Armdroid, from a kit and on the evening *Your Computer* visited the club he gave a talk on robotic software. Computer club speakers do not always succeed in conveying the interest of their subject.

Chris Stevenson, however, did so in vivid fashion — at one point graphically representing the workings of a stepper motor with a series of sideways jumps.

Initially Chris Stevenson had been bitten by the bug of wanting to control something. But in the process of developing the software to control the arm he had discovered Forth. Basic had been too slow, while assembly language was too cumbersome: Forth proved to be just right.



Chris Stevenson of Nottingham Computer Club demonstrates the Armdroid

The Armdroid, which had cost £250 and had taken him 30 hours to build, was linked up to a Pet. He started the talk by putting it through its paces. Robots are always popular and when the Armdroid managed to pick up a knob it received a round of applause. Enthusiasts pointed out that it takes a baby three months to learn this feat. Later as its party piece the robot played a game of noughts and crosses.

Only four out of the 40 present had written programs in Forth so he proceeded to give an excellent introduction to the language, which he described as quite the most interesting language around.

The principle difference between Forth and other languages, he explained, was the way it handles data. This and other Forth mysteries such as the stack, the dictionary, the use of reverse polish, were made clear with the aid of some simple program examples.

Talks like this, along with demonstrations, are a regular monthly feature at the Nottingham Club. On a previous occasion a musical micro contest had been held between six different computers. The winner was a BBC Micro which played a Bach suite accompanied by fancy graphics.

Other weeks of the month are given over to user groups. Sinclair, Commodore, Atari, BBC and Dragon owners are all catered for.

One unusual facility the club offers is the chance to rent a computer. For £1.50 a week members can hire a ZX-81, while anyone enthused by the evening's talk could hire a Jupiter Ace for £2.50.

The Nottingham club meets on Mondays at the Congregational Centre on Castle Gate. For more details contact Geoffrey Jago on 0602-621453. ■

Local society news

Lancaster anniversary

LANCASTER AND MORECAMBE Computer Club is celebrating its first anniversary with an Open Day in October at the Town Hall, Lancaster. Normally the club meets every fortnight on Tuesdays at the Greaves Hotel, Lancaster. Meetings alternate between discussions and displays, and programmers' workshop evenings. The club also runs courses in Basic and machine code. For details contact David Smith on Lancaster 33279.

Members for Bloxwich

BLOXWICH COMPUTER Club has just formed and needs more owners in the area to join it. Meetings are every Wednesday evening at the Frank F Harrison Comprehensive School in Leamore Lane, Bloxwich.

Wrexham computing

MEETING OF the Wrexham and District Computer Club are attended by over a 150 people and cover talks on the latest hardware, machine comparisons, demonstrations and beginners courses. It meets on most Thursday evenings at Wrexham Memorial Hall.

Sutton sessions

SUTTON LIBRARY Computer Club, in Surrey, is open to anyone whether experienced or starting out. No machine is necessary and 25 percent of the membership do not own one. There are Acorn and Sinclair user groups and sessions for Dragon and Oric owners are planned. Meetings take place on the first Friday and third Tuesday of every month. More from Paul Sedgwick on 01-661 5667.

Star chart

Catcha Snatcha

Vic-20: Novelty: £5.50: Imagine.

★★★

Cast in the role of a store detective, your task is to patrol the premises contending with shoplifters and lost property. An amusing and original game.

Monopole

CBM 64: Board-game: £5.99: Rabbit.

★★

Uses the CBM's predefined graphics to display the Monopoly board and keeps track of properties held and transactions made. Sadly no computer-versus-player option.

Cyrus IS Chess

16/48K Spectrum: Board-game: £9.95: Sinclair.

★★★★★

Adapted from a competition-winning program by Intelligent Software, Cyrus plays an exceptionally fast and strong game. Fits into 16K with eight levels of play and full board display.

Magic Mountain

48K Spectrum: Adventure: £4.95: Phipps Associates.

★★★★

Graphic adventure game along the lines of Hobbit. Familiar landscape of mountains, caves, tunnels, dungeons, rivers peopled with dwarves, lizards and spiders. Not as good as Hobbit but engrossing enough.

Gridrunner

Dragon: Shoot-'em-up: £7.95: Salamander.

★★★

Joystick-only game in which you must roam the Grid destroying Droids and Pods while avoiding X/Y Zappers. Quite enjoyable for a Dragon game but not a patch on Jeff Minter's brilliant Vic-20 original.

Xenon

Oric: Shoot-'em-up: £8.50: IJK.

★★★★

Colourful Galaxians variation with five phases of play.

SOFTWARE Shortlist

Pssst

- *16/48K Spectrum*
- *£5*
- *Ultimate Play The Game*

★★★★

A WORKING knowledge of insecticides will help you more than green fingers in Pssst's pest-infected garden. You control Robbie, a robot gardener, whose job is to protect his plant, a Chrisanthodil, from the attentions of slugs, leeches and midges.

Three spray cans aid you in this task, but only one delivers a lethal dose — the others merely stun. If you succeed in destroying enough insects your plant grows, sprouts leaves, and eventually rewards you with a flower. Play then proceeds to the next screen where the action is, of course, faster and more crowded.

At this stage the game takes on a pleasingly frantic quality. If the garden is not to turn into a horticulturist's nightmare, you need to scurry about madly picking up and putting down sprays, Grow-bags, and watering cans.

Although Pssst has some elements in common with Ultimate Play The Game's other game, Jet-Pac, it is otherwise refreshingly novel. But what marks it out as exceptional is the quality of its graphics.

If Ultimate Play The Game can achieve affects like these with the Spectrum's relatively modest screen and colour resolution one wonders what it could produce for the BBC or the CBM 64.

Jumpin' Jack

- *16/48K Spectrum*
- *£5.50*
- *Imagine*

★★★★

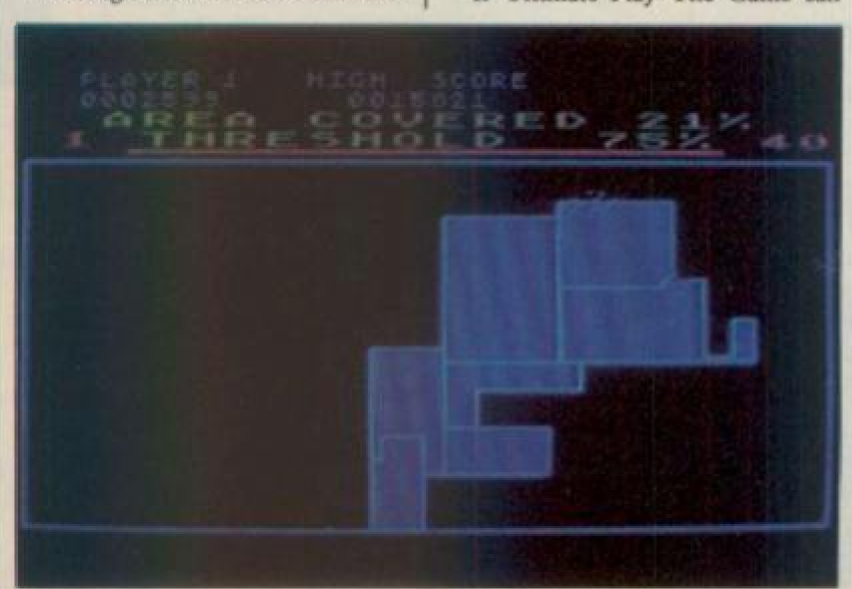
"JUMPIN' JACK is quick and bold with skill his story will unfold." This is the first rhyme you encounter in Imagine's Jumpin' Jack, a quirky and clever game which is much better than the poetry which punctuates the player's progress.

The object of this addictive game is to move your man, the Jack of its title, to the top of a series of screens consisting of horizontal lines. To move up you must jump through the holes which appear; to avoid dropping through them you can run right or left.

Jack himself is an ingenious piece of graphic design, all pumping legs and flailing elbows. When you mistime your jump, poor Jack is electrocuted on the lines and writhes in truly gruesome convulsions.

At the beginning of the game there are no obstacles to progress, except your own ineptitude. However, when you have conquered screen 1 not only do you see the next line in the limerick you complete by finishing the game, but you also come up against the first hazards. These are either a pretty little steam-train, a manically chopping axe or a lunatic with a shotgun.

Jumpin' Jack has the charm of a nursery rhyme and the cruel twists of fortune of snakes and ladders — or even life, if you like to see deep meaning in the hours spent with your micro.



Qix

- *Atari 400/800*
- *£29.95 cartridge*
- *Atari*

★★★

QIX FROM ATARI is a refreshingly abstract and almost non-violent game, but no less gripping for that. The Qix of the title is a whirling collection of lines which you must box in by filling at least 75 percent of the screen with blocks of colour.

To do this you draw lines — called Stix, says the blurb — with your marker controlled by the joystick. The interest of the game lies in the different strategies possible and the unpredictable properties of the Qix and your other opponents.

Some players like to build bizarre patterns of boxes in an attempt to imprison the Qix in a tiny area, since any percentage over 75 is rewarded with a bonus multiplied by 1,000. Bluff, no-nonsense players, prefer however, to get it over with quickly by blocking off large areas immediately.

This strategy, though, can be dangerous — the Qix is a capricious creature. If you have not completed a line and the Qix touches it the game is up.

You must also watch out for the Sparx twinkling along the lines and multiplying the longer you play. If you are slow completing a box, or try to cross one of your own lines, then the fuse will ignite and come fizzling after you.

The game starts with only one Qix to capture, but if you are skilful, you soon move on. That is when Qix becomes really difficult and really compelling.

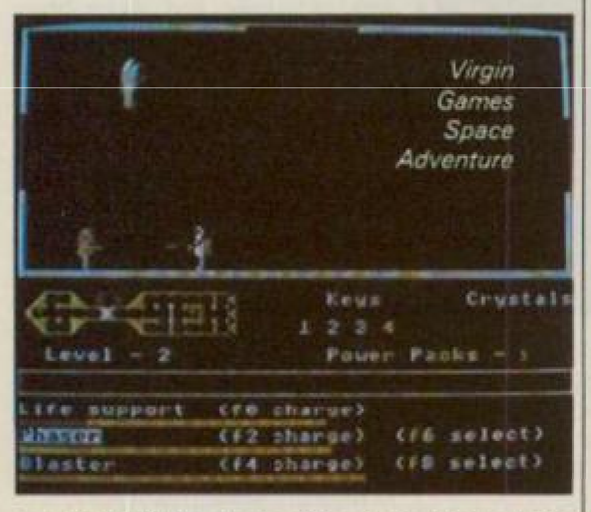
From submarines to soccer, from snooker to starships, Pete Connor takes a hard look at BBC software.

"SPORT FOR ALL" is the theme of this month's survey, as your reviewer laces up his football boots, casts a shrewd eye over the racecard and chalks his cue in preparation to break the pack of new BBC Micro programs.

First under the starter's orders is Professor Frank George's H5 Horse Racing Forecast Program, which takes the punter into the age of the microchip. No longer does he have to ponder the evidence entirely on his own, or resort to using the pin; now he just has to key in the relevant data and let the Prof's program do the work. This it seems to do pretty well; of the four races I used, the program strongly recommended the winnner in three. Unfortunately, it also recommended one or two others equally strongly, so the gambler still has some decisions to make on his own.

Before all BBC owners write off for the H5, they should pause and reflect on the amount of work involved in using it. For each runner there are at least 10 separate items to be keyed in. For races with large fields you will need the patience of Job and the leisure of Andy Capp. Even so, there are still many factors the program does not take into account before giving its verdict of Eliminate, Possible Bet, Very Good Bet, or Excellent Bet; the state of the going, jockeyship, illness. These have to be considered, the H5 booklet says, after the program has one its work. Professor George's program, then, is one for the dedicated micro-owning follower of the turf rather than the dilettante. With regular use it might well repay the outlay of time and money involved.

From the sport of kings we move to the sport of misspent youth — snooker. Acornsoft's Snooker is the first such game to be produced for the BBC, and it is very effective. The coloured balls stand out well



against bright green baize. You direct them using four keys to position the cue.

You can choose strength of shot, backspin and topspin, and so on. The program automatically registers foul shots and adjusts the score. Snooker is not quite as satisfying — or frustrating — as the real thing, but it is certainly a lot less trouble than queueing at the local hall.

Two other new games from Acornsoft are Missile Command and Starship Adventure, neither of which will hold any terrors for anyone familiar with an arcade. The first is a very good version of Missile Base, where you have to move a target finder to lay down a protective blanket of exploding bombs. There is a good variety of screen colours and the graphics are very clear; the sound, though, is a bit feeble. A daunting prospect in this game is the "intelligent missile". I was too incompetent to encounter them. You should enjoy this game if you have a joystick; if you do not you will find yourself trying to use eight keys at once.

Starship Command is an interesting hybrid of Asteroids and the Star Trek genre; on the left is a screen where you rotate your ship to fire at the enemy, on the right a display showing position and fuel supplies. You can put up shields and launch an escape capsule when things look dire. You might get another mission; it all depends on the Admirals back at starbase — a hard bunch to please in my experience.

Match of the day

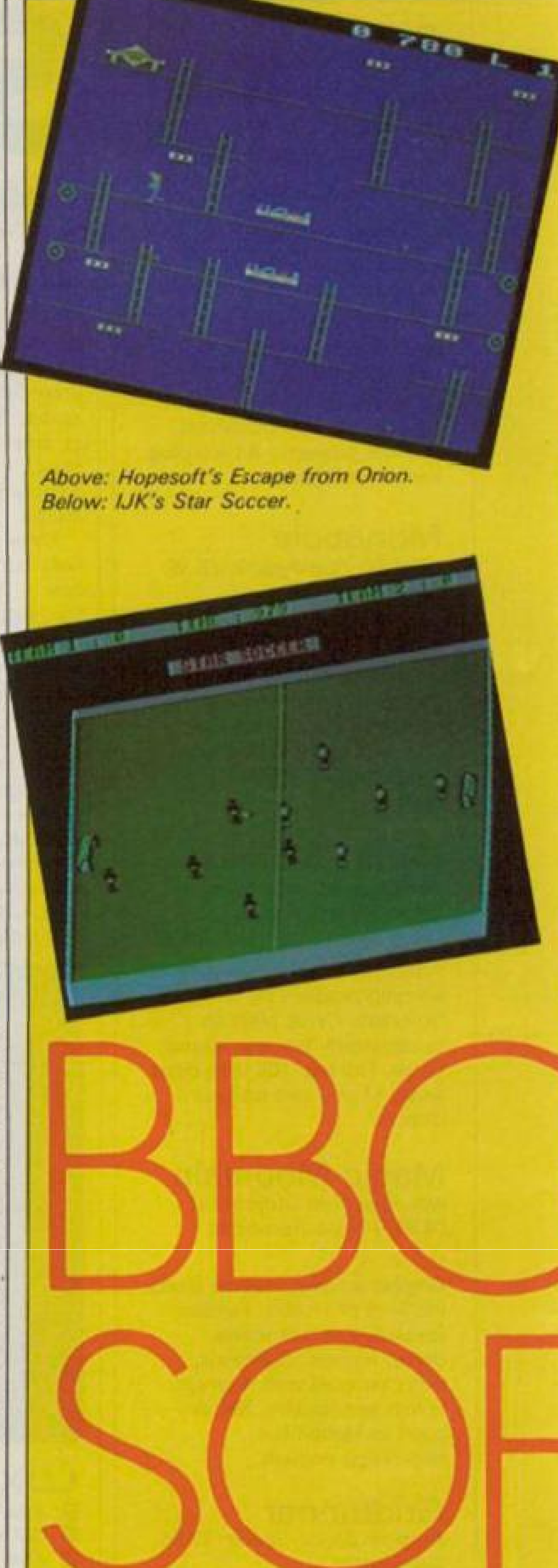
For something more vigorous and down-to-earth there is Five-a-side Socca (sic), a two player game from IJK. This is an exciting computer version of table football, in which you move your players around, tackle and shoot.

In the style of English football, there is no great individualism on display. Your players move in strict formation, each man playing for the team rather than himself. They give 100 per cent effort and cover every blade of grass on a pitch so luxuriant it puts Wembley to shame. And it is magic when you shoot and the ball hits the back of the net. I was over the moon with this one, Brian. IJK also produce Leap Frog, their version of Frogger. It is the usual thing with the usual graphics and sound, but the road has lane markings. Is this a major new development in Frogger technology?

Atlantis, from the same company is altogether more alluring. It starts with a rousing blast of classical music and then goes on to mention Plato — of all people — in the introductory blurb. By this time the disoriented games player may be wild-eyed with astonishment. But persevere! For what you get is, in fact, no less than an aquatic version of Scramble — a brave attempt to do something new with this game.

Instead of spaceships you have five Nautilus submarines armed with torpedoes and bombs. The rugged terrain with which we are all so familiar is still there, but it is all underwater now. The graphics are good and even at the



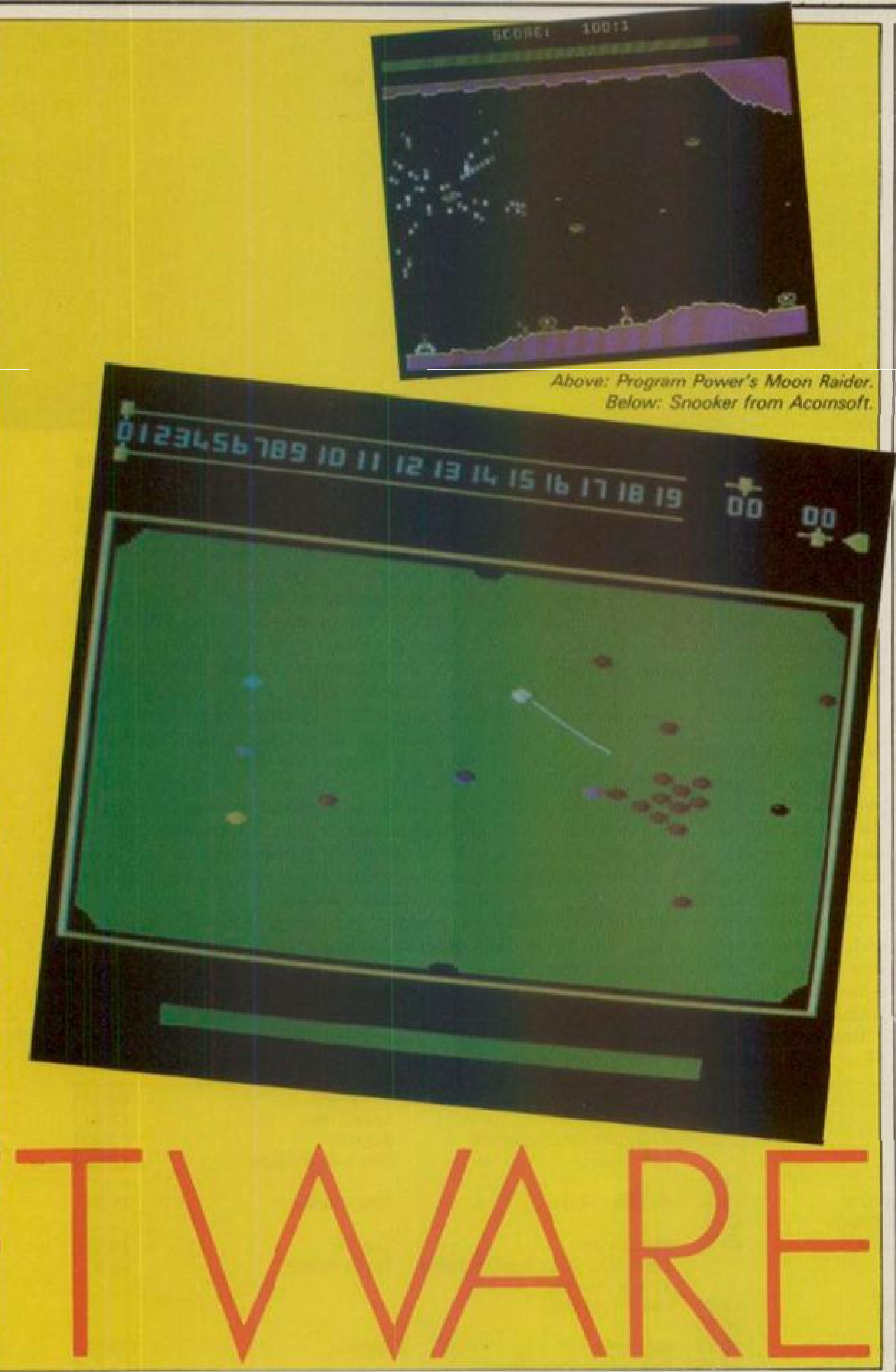


Above: Hopesoft's Escape from Orion.
Below: IJK's Star Soccer.

lowest level it is a difficult game to master. One minor drawback is that the torpedoes make a noise like squealing piglets.

While we are on the subject, there is Moonraider from Program Power. No nonsense about philosophers and myths here — this is a straightforward Scramble game. It is very similar to Acornsoft's Rocket Raid in terms of graphics and sound, although you can choose the additional hazard of ack-ack fire. That, plus the whizzers, is a pretty daunting prospect.

The major, and controversial, development in this game is the "skip" facility. Families will split on the issue of whether this should



Above: Program Power's Moon Raider. Below: Snooker from Acornsoft.

SURVEY

ever have been invented, let alone used. I take no side in this dispute, but wonder if Baron Von Richthofen would have got where he did if the Kaiser had let him skip to combat before he had learned to fly.

Heiress on a high-rise

Program Power's Croaker is a standard issue Frogger game, but their Killer Gorilla is much more fun. In this Donkey Kong variant the hero has to rescue the captured heiress from a gorilla at the top of a skyscraper.

The boy does not really seem old enough to be going around rescuing heiresses, even ones who look like Goldilocks. But let that pass. This is a very amusing and compelling game. As you progress through the pages the obstacles and aids become more inventive; you go up and down in lifts, grap umbrellas and dodge falling girders.

Another entertaining variation on the same theme is Escape From Orion by Hopesoft, which claims to "take Donkey Kong into the 21st Century." Again, there are different obstacles and aids as the pages turn over; ladders, lifts, conveyor belts with explosive devices, electrified doors. It is an entertaining game with inventive graphics, but does not quite have the charm of "Killer Gorilla".

Computer Concepts has produced two very good new games. Swarm is a distant relative of Galaxians in which birds swoop down making convincingly unpleasant avian squawks. There is the added danger that they lay very large and very evasive eggs which turn into eagles if not destroyed. If you have seen Hitchcock's film *The Birds* you may have an idea of the unpleasant thrill to be derived from this game.

Android is one of the best games to appear recently. A boy runs round a maze trying to eat the energy pills before being caught by the pursuing androids, elasticated creatures which expand and contract in a menacing fashion.

To destroy these the boy either turns and shoots them with his pistol or lays bombs which can later be detonated. Then he has to face the disagreeable pink monsters — a pink monster is always very nasty — and, last, a creature which knows no barriers, floating over the screen and through the walls. The graphics and colour in Android are excellent, and the game has an appeal which is unique.

Which brings us to Bug-Bomb, one of the first games to be released by the new Virgin software house. All the Virgin games come with a heavy load of packaging, including photographs of the writers.

Some of these are not a pretty sight, and should be kept away from sensitive adolescents. Bug-Bomb has similarities to Android; you run around a grid, avoiding the bugs and trying to destroy them by releasing a cleaning agent. The game starts very fast and furious and is an effective development of a simple idea. Even though it lacks Androids' graphics originality, it will please many people.

Lost in space

Virgin's Landfall is a sophisticated flight simulator with just a hint of Star Trek games in there somewhere. You must land your rocket using the map and the plethora of information on the control panel. If you like this sort of game, then you will probably find Landfall an absorbing program.

Most entertaining of the Virgin programs is Space Adventure, a graphic adventure with action. Here you are a spaceman in a three-level space-ship, infested with androids protecting the power capsules you seek.

A plan of the craft is shown, and each individual room is represented by a rectangle in which you and your android opponents bounce around in zero gravity and shoot it out with phasers and blasters. To stay alive you have to find new power packs. Space Adventure is a pleasing mixture of violence and logic.

Kansas City has a reasonable version of Frogger on the market, with all the usual obstacles. The joke here is that the introductory tune is the Marseillaise. Geddit!!!

Superior Software's Frogger is similar, although it is slightly more demanding in that you must move sideways as well as ahead. The graphics are good and the crocs really do look both vicious and voracious.

(continued on page 54)

(continued from page 53)

Road Runner, also from Superior Software, is an intriguing game in which you guide a car around a maze-like racetrack. You score points by passing the flags. However, you are pushed by hostile cars which you can throw off the trail by laying a smoke-screen. Additional problems are caused by rocks in the road. If you drive in London you should be at home in this fast moving game.

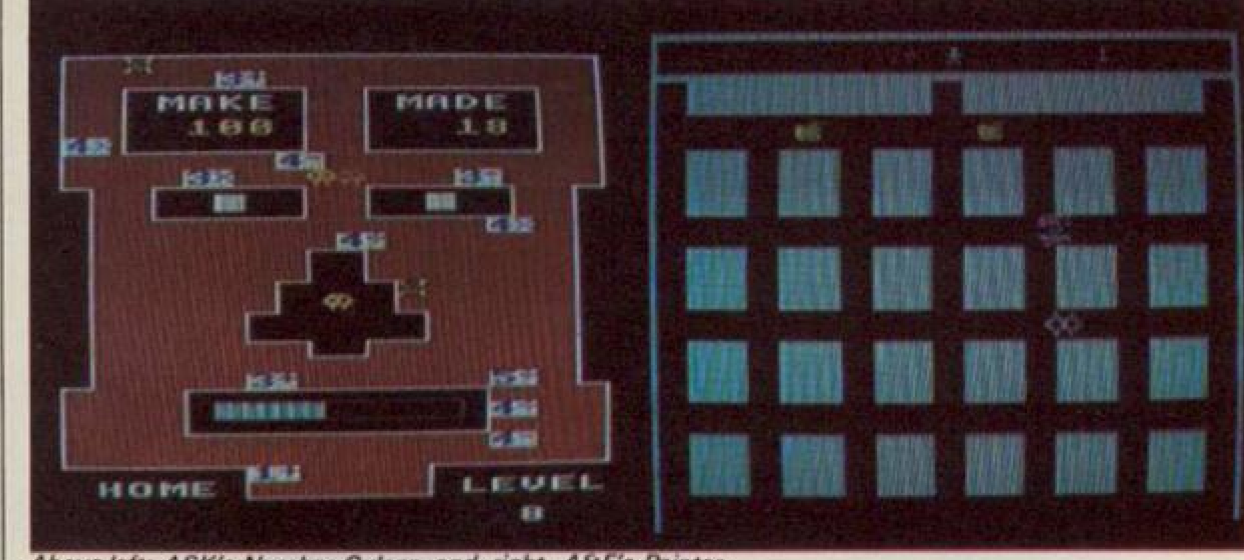
Painter, from A&F, is a rather less frantic game. The screen is filled with rectangular blocks around which you move. Once you have gone around all the sides, the block is filled in and you score points. Chasing you are whirling opponents who multiply as the game proceeds. It is a simple idea, but no less effective for that.

As welcome relief from all these frogs crossing roads ASK now have several new educational programs available. All of these programs use colour and graphics to take the sting out of learning. Number Gulper, for instance, uses the format of an arcade-style game to help children improve number skills. The player selects a number to make and a different number appears in one of the eyes which are part of the robotic face constituting the screen.

The player's Number Gulper then has to be guided around the screen, multiplying, subtracting or adding the numbers scattered around. Time is limited and, at the higher of the 19 levels, there are scramblers which can really mess your number up. The game can become very fast and exciting and is undoubtedly one that children — and adults — will find enjoyable and educational.

Let's Count is designed to help younger children learn simple counting and the numbers up to 9. There are four different games each with colourful graphics and jolly time. If the child repeatedly fails to find the answer, the program will help.

Number Puzzler is another program designed to enhance mental arithmatic skills, this time by means of a numerical noughts and crosses. Other options are mental arithmetic contests with friends, or against the computer. Hide and Seek aims to improve short-term memory using games similar to the ones where you put objects on a tray, look for thirty seconds and then try to name them. The colourful graphics and different options mean that children will not easily get bored using this program. A useful new program for those with a practical interest in computing.



Above left: ASK's Number Gulper, and, right, A&F's Painter.

Versatile monitor

Beebug's Exmon is an exceptionally comprehensive machine code monitor. As well as the usual spread of monitor facilities — a disassembler, register display, memory search, and so on — it provides two useful extras: a relocator and a simulator.

The relocator moves a program in memory and, as far as possible, adjusts it to run at the new location. The simulator allows you to test a machine code program a single step at a time while displaying the contents of the registers.

Exmon would be hard to improve upon. In 5K it manages to provide all the facilities you are likely to need in developing and testing machine code.

Those interested in the BBC's sound facilities would do well to look at Quicksilva's Muproc or Bug-Byte's BBC Music Synthesiser and Auto-Composer.

Both programs are similar in that they allow you to compose tunes on the BBC's four channels using a wide variety of pre-defined sounds. You can also combine these sounds to get some you might not have heard before. Although there is little to choose between the performance of these programs, Muproc is perhaps the more fun to use.

It cleverly simulates a four-track recording studio, displaying sound levels on the different channels, allowing you to have fast forward or back, lay down a funky rhythm here some mellow strings there; you can really indulge your musical fantasies.

Muproc also scores over the Bug Byte program because it is less cumbersome to use, with a clear screen display and lucid explanatory booklet which avoids the apalling spelling errors to be found in the Bug-Byte program. There is certainly room on the market for an educational spelling game. ■

Company	Program	Price
A&F Software, 830 Hyde Road, Manchester, M18 7JD.	Painter	£8
Acornsoft, c/o Vector Marketing Denington Estate, Wellingborough, Northamptonshire, NN8 2RL	Snooker Starship Adventure Countdown to Doom Missile Command	£9.95 £9.95 £9.95 £9.95
ASK London House, 68 Upper Richmond Road, London SW15.	Number Gulper Lets Count Number Puzzler Hide & Seek	£9.95 £9.95 £9.95 £9.95
Beebug, PO Box 109, Baker Street, High Wycombe, Buckinghamshire.	Exmon	£7.90
Bug-Byte Mulberry House, Canning Place, Liverpool L1 8JB.	Music Synthesiser	£9.50
CC Software, 16 Wayside, Chipperfield, Hertfordshire WD4 9JJ.	Android Attack Swarm	£8.95 £8.95
Hopesoft, Hope Cottage, Winterbourne, Newbury, Berkshire.	Escape from Orion	£6.75
IJK Software 9 King Street, Blackpool Lancashire.	Leap Frog Atlantis Five-a-side soccer	£7.50 £7.50 £7.50
Program Power	Killer Gorilla	£6.95
Micropower Dept AU3, 8/8a Regent Street Chapel Allerton, Leeds LS7 4PE.	Croaker Moon Raider	£6.95 £6.95
Quicksilva, Palmerston Park House, 14 Palmerston Road, Southampton S01 1LL.	Muproc	£14.95
Superior Software 69 Leeds Road, Bramhope, Leeds.	Road Runner	£7.95
Virgin Games, 61/63 Portobellow Road, London W11 8DD	Bug-Bomb Landfall Space Adventure	£7.95 £7.95 £7.95
Sporting Forecasts Bureau of Information Science, Commerce House, High Street, Chalfont St Giles, Buckingshire.	Horse Racing forecast	£19.95

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DEALERS ENQUIRIES WELCOME

Kathleen Peel takes the wraps off the COMX 35. With a built-in joystick and 35k memory the new arrival is full of Eastern promise.

THE COMX 35 is well made and nicely packaged, supplied complete with cassette leads, a cable to connect to your domestic TV, a power supply with integral three pin plug and a Basic Manual.

The keyboard houses plastic keys with a calculator-type feel but without any loud speaker feedback. Because of its size it is unsuitable for touch typing. The joystick is centre-biased and produces non-printing codes when activated; its use is mainly for self-written and commercial games.

The cassette interface at 600 baud seems relatively trouble free and actually requires that both earphone and microphone leads are left connected. This allows a spoken header for each tape track which is heard through the computer loudspeaker on playback. Both program and data files may be saved.

Expansion is through a double sided 44-way socket, at present no information exists as to the connections of the socket.

There are plans for an RS-232 — Centronics interface to take a suitably badge-engineered version of the extremely popular Sharp four-colour printer plotter. Floppy disc drive, speech synthesiser and memory expansion to 67K are all as they say "to be available shortly".

The machine is one of the coolest running micros I have seen, it barely heats up which is a good indicator as to the reliability of the electronics.

The Computer is based on the RCA 1802 microprocessor — an 8 bit register-orientated central processing unit, CPU. Its main features are low power consumption, a register array, R0-RF, consisting of sixteen 16-bit scratchpad registers and 91 easy-to-use instructions. A summary of the registers is given in table 4.

Switching on repeats a display routine waiting for any key other than space to be pressed. It then prints on the screen

```
COMX Basic V1. 00
READY.
```

As you enter data it is printed in white with the computer response which can be selected, in cyan and the cursor in pink, an interesting use of colours for data presentation.

Program errors are denoted by error codes which although easily referenced in the manual, will be of little use to the inexperienced beginner without further explanation. For instance "unacceptable character in number fold" is the explanation for error code 45.

Editing a line is simple. The line is called into the editor and displayed at the bottom of the screen, the cursor is spaced along underneath the line to the desired position and either I,C or D is typed — Insert, Change, Delete — and the amendment made on the cursor line. Typing Control S puts the correction into the edit line and allows further changes. A second Control S puts the corrected line back into the program. The maximum line length is 95 characters and the cursor line commences below the end of the line to be edited, so it may be displaced by up to three lines which is a bit confusing. Not the best editor I have seen, but by no means the worst.

A novel command, Control R, recalls the text prior to the last press of the return key with any data typed after the return superimposed at the beginning of the line. Very useful for changing line numbers and minor changes at the end of often repeated commands.

At switch on there are 30934 Bytes available to the user according to Print Mem. It prints 256 less than actually available to allow for stack growth. The Basic implementation on this micro has one major drawback — it is incredibly slow, taking approximately four times as long to complete the timing tests used for the Spectrum — Oric evaluation presented in the March 1983 issue of *Your Computer*.

The usual selection of Basic commands are available, but disturbingly the manual has no references to any printer command.

This indicates the level of standardisation of COMX Basic. Table 1A lists commands which just vary in the keyword and Table 1B lists commands that are either not defined in the dictionary or have a non-standard meaning.

Redefinable character set

There are no simple structures such as If — Then — Else and On — Gosub but their relevance is debatable. The Basic interpreter inserts and deletes spaces as it merrily tidies up your data entry. As you may type PR — a shortened form of PRINT, there is a slight problem with lines such as PR INT (A /256) which the interpreter resolves as PRINT (A /256).

The whole of the character set is redefinable by using the Shape command, each character being formed within a 8 × 9 character cell. The two most significant bits are used to define the colours and the remaining six the pixel content of the relevant row of the character. This theoretically is capable of giving high resolution and the program below does that. As you can see, not all the character codes are usable within the display and the user is left with about 112 definable characters. The characters are duplicated in the top and bottom half of the character set, each half able to use a set of four colours — Black, Blue, Green and Cyan or Red, Magenta, Yellow and White.

Unfortunately, there is a slight problem, whenever the shape command is used, the screen nearly always blinks — it seems to be a timing problem. If the programmer does not redefine characters whilst a program is running then this will not be a problem.

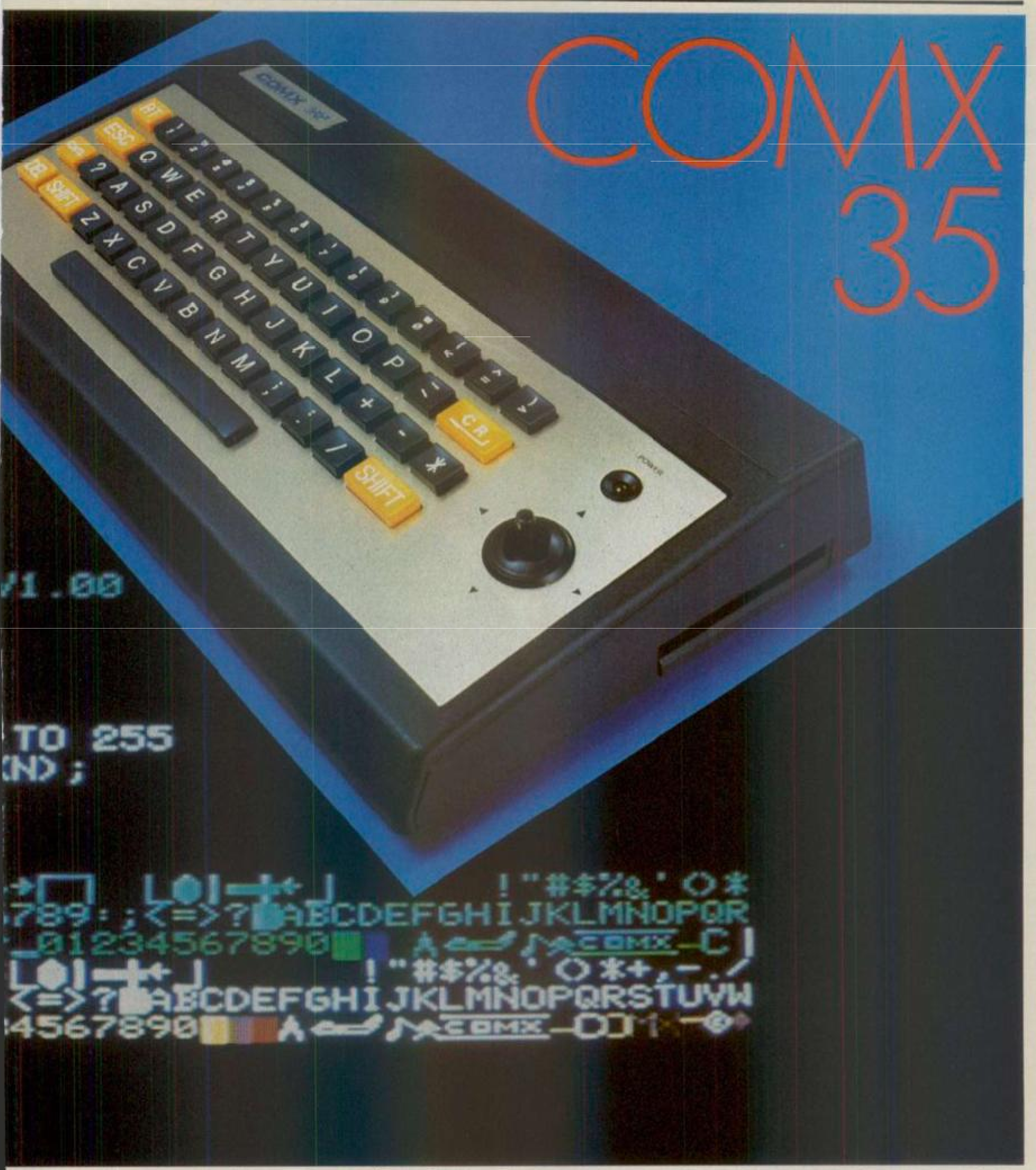
There are no Draw, Plot and Circle commands which is not surprising as the display does not appear to be memory mapped. This is the hi-res program:

```
1 B=0:CPOS (0,0):CLS
2 FOR A=32 TO 127:GOSUB 7:NEXT
3 FOR A=144 TO 255:GOSUB 7:NEXT
4 GOTO 2
7 PRINT CHR$ (A);:B=B+1:IF B>958
  EXIT 10
8 RETURN
```




```
10 Z$="0123456789ABCDEF":FOR A=144
   TO 255:GOSUB 50:NEXT A
12 WAIT (500):GOTO 12
50 A$="":FOR B=0 TO B1:C$=MID$
   (Z$, 1+INT(RND(15)),1):A$=A$+C$:
   NEXT B:SHAPE (A,A$):RETURN
```

I mentioned earlier that data entry from the keyboard is white and the computer response cyan, which can be changed to a number of other permutations. Unfortunately there is a



side effect, coloured graphics entered via the keyboard in a program change colour when printed by the computer.

Larger picture

The machine has the usual six colours plus black and white. The paper colour covers the whole screen for all colours and does not leave a border like on the Oric or Spectrum. The display which is 24×40 characters covers virtually the whole of the TV screen and gives a picture almost 20 percent larger than the Spectrum with the same character definition. Spectrum definition is 24×32. Colours are good, stable with very little noticeable dot crawl. The colour commands are in table 3.

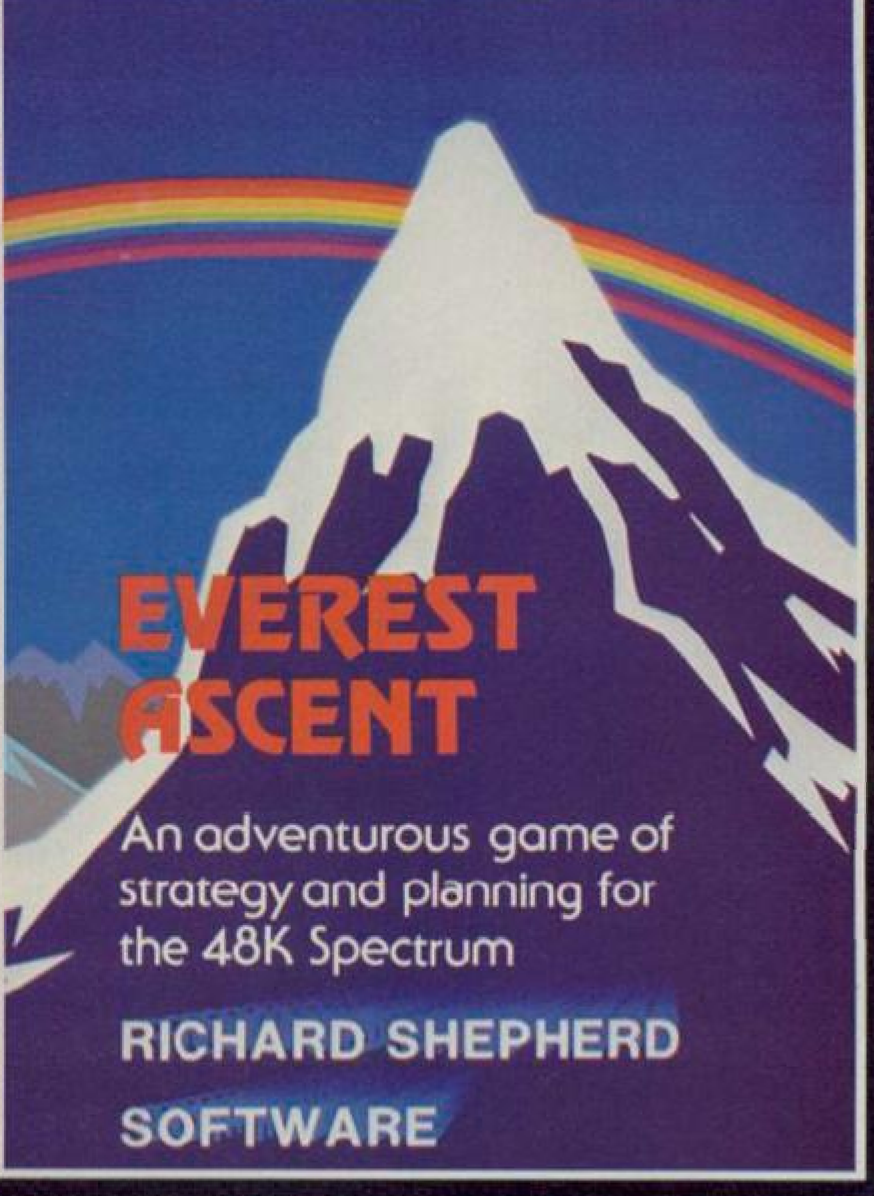
The sound commands in table 2 are also good and capable of giving a wide range of realistic noises from lasers to explosions, and could even provide a fair imitation of speech which would give an extra dimension to games. Although the machine does not suffer from the dreaded Sinclair power supply hum, there is a hum coming from the loudspeaker which is annoying.

The joystick is effectively four additional keys which are activated by pushing the joystick in an appropriate direction. These keys produce non-display character codes

(continued on page 59)

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(continued from page 57)

which auto-repeat and can be read by the key function. This returns the ASCII code of the current key being depressed. So If Key = 136 Then. . . . Because of the nature of the keyboard scanning routine, the use of the key facility in a program such as figure 2 creates problems and does not smoothly move the character around the screen. It is necessary to make the variable the value of the last key pressed and integrate the variable as in figure 2. This point is omitted from the manual.

The content of the manual for the beginner is good and quite clear but spoilt by rather too many silly errors. There is virtually no technical information in the manual. It really should include 1802 assembler instructions, memory maps, system variables and I/O socket connections. They may not be required initially, but you will not get very far without them.

Glancing through the ROM reveals three commands not in the manual. Dos Pout and Tout. Dos and Pout give error code 62, "ROM or ROM card not present" and Tout reruns Ready. There appear to be ROM routines for double and quadruple-size printing available which should be very useful.

CONCLUSIONS

- The Comx 35 cannot be recommended for business use as it lacks speed and a suitable keyboard.
- If an adequate library of high-quality machine-code arcade games can be assembled then the Comx 35 could be treated as a games machine with computing capabilities, where the integration of a joystick with the keyboard will make for a more realistic arcade-style presentation than a normal keyboard. The demonstration tape contains some good machine-code arcade-type games.
- For a 1983 computer it has an extremely slow version of Basic and it uses an outmoded CPU which is unknown in today's popular micros.
- It has an incomplete version of Basic and some commands have non-standard meanings.
- Error codes need to be more explicit about the nature of the error and could be greatly enhanced by the use of examples in the manual.
- It has a non-standard size keyboard.

Program to print out character set and pause while space key depressed.

```
 1 FOR A=1 TO 255
 2 IF KEY=32 THEN GOTO 3
 5 PRINT A, CHR $ (A);
 8 NEXT A
10 END
```

This modification is required to enable the above program to work.

```
 3 IF KEY=32 THEN WAIT (20) : GOTO
```

Table 1. Comx 35 standard Basic commands.

ABS ASC ATN CHR COS DATA DEFINT
DEG END EXP FOR-NEXT GOSUB GOTO
IF-THEN INPUT INT LEN LET LIST LOG
MEM MID MOD NEW PEEK POKE PI PRINT
RAD READ REM RENUMBER RESTORE
RETURN RND SGN SIN SQR TAB WAIT

Table 2. Sound commands.

MUSIC	Note, octave, amplitude.
NOISE	Frequency, amplitude.
TONE	Frequency, octave, amplitude.
VOLUME	Level.

Figure 2. Operating joystick.

```
10 CPOS (0, 0) : CLS
20 A=12 : B=20
30 IF K =136 THEN A=A-1        Up
40 IF K =139 THEN B=B-1        Left
50 IF K =138 THEN A=A+1        Down
60 IF K =137 THEN B=B+1        Right
70 CPOS (A, B) : PR "*"
80 GOTO 30
```

Table 3. Colour commands.

COLOUR (N)	Where N=1 to 12 and represents the colour combination used for keyboard input and computer response — initially set at 12.
SCREEN (N)	where N=1 to 8 and represents the background colour — default set to 1, black.
CTONE (N)	N≠0: computer response a shade brighter than the screen colour. N=0: effect turned off.

Colour and screen are global and affect the whole of the display.

Table 1b. Non-standard Basic commands.

CALL (NN, a, b)	Transfer execution to machine code routine at address NN passing data a and b into R8 and RA.
CLD	Clear all strings and arrays.
CLS	Clear screen from current cursor position.
CPOS (Y, X)	Place the cursor at position Y,X.
DEFUS NN	Creates a space between variables and the start of the program (NN) to be used for machine language routines.
DIM	A maximum of 26 arrays limited to 255 in any dimension, also 26 strings maximum. Destroyed by Run, New, CLD and perhaps Editing.
DLOAD	Load data stored by a previous DSave.
DSAVE	Save data for subsequent retrieval by DLoad.
EOD	Prints hex address of end of data.
EOP	Prints hex address of end of program.
EXIT N	Unconditional branch to line N. If used as an escape from a For/Next loop it should jump to the next level down of nesting if applicable.
FIXED N	Formats the printing of all numbers. N is number of digits to the right of the decimal point.
FNUM (exp)	Round to nearest whole and convert to floating point.
FORMAT N	Specifies field size N for printed numeric data until turned off.
INUM (exp)	Round to nearest whole number and convert to integers.
PLOAD	Load program stored by a previous PSave
PSAVE	Save program for subsequent retrieved by PLoad.
RND (N)	Returns a random floating point number from 0 to less than N. A=RND (15) will not work. A=INT (RND (15)) is acceptable.
RUN N	Runs program from line N but does not clear the data space.
RUN +	The computer replaces all interpretive branches such as Goto 150 with absolute addresses and then Runs the program.
SHAPE (A, "18 HEX numbers")	Redefines character code A — see text.
TIME (T)	Time to elapse before jumping to subroutine
TIMEOUT (N)	Address N — 50 units per second for T.
TRACE (A)	A30 Trace off A≠0 Trace on.
USR (NN, a, b)	As call but used as part of an expression returning a 32-bit binary integer number constructed from R8 (low) and RA (high).

Table 1A.

FVAL=VAL	KEY=INKEY

Figure 3.

Program	Comx 35		Spectrum
1 B=0	RUN	RUN +	
10 FOR A=1 TO 10,000			
15 GOTO 20			1 LET B=0
20 B=B+1	400 secs.	350 secs.	20 LET B=B+1
25 LET K=KEY			
30 NEXT A			50 STOP
40 PRINT A, B			
50 END			100 secs.
80 GOTO 25			

Table 4. 1802 Register summary.

D	8 Bits	Data Register (Accumulator)	N	4 Bits	Holds low-order Instruction digit.
DF	1 Bit	Data Flag (ALU Carry)	I	4 Bits	Holds high-order Instruction digit.
R	16 Bits	1 to 16 scratchpad Registers	T	8 Bits	Holds Old X, P after Interrupt.
P	4 Bits	Designates which register is program counter.	IE	1 Bit	Interrupt Enable.
X	4 Bits	Designates which register is data pointer.	Q	1 Bit	Output Flip-Flop.



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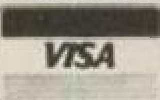
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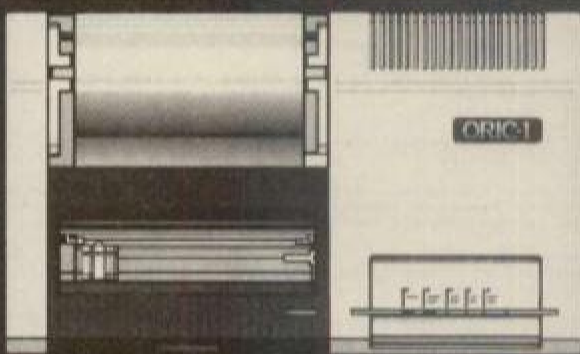
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Table 1. Variables used.

o$	array of object descriptions
l	array of object locations
i	number of objects being carried
set	pointer to subroutine that deals with the current location
up, do, we, no, so, ea	pointers to surrounding locations
l$	current location description
i$, a$, b$	input string, command and parameter respectively
init	pointer to initialisation routine
n	For-Next control variable
fed, found, sp, und, unc	various flags

TIME



```
  10 LET a$="": LET fed=0: LET i=0: LET set=1000: LET init=5000
  12 POKE 23609,10: BORDER 0: PAPER 0: INK 7: GO SUB 8000
  15 GO SUB init
  20 LET no=0: LET we=no: LET ea=no: LET so=no: LET up=no: LET do=no
  30 LET l$="": GO SUB set
  40 CLS : PRINT 'l$
  60 LET found=0: FOR n=1 TO 11+(set<>1180): IF l(n)<>set THEN NEXT n: GO TO 90
  63 IF NOT found THEN PRINT : PRINT "I can see...": LET found=1
  65 PRINT "a ";o$(n)
  70 NEXT n
  80 GO TO 100
  90 IF a$="look" AND NOT found THEN PRINT "I can't see anything special"
 100 BEEP .01,10: INPUT "What shall I do ?:"; LINE i$: IF i$="" THEN GO TO 100
 102 FOR n=1 TO LEN i$: IF i$(n)>="A" AND i$(n)<="Z" THEN LET i$(n)=CHR$ (CODE i
$(n)+32)
 103 NEXT n
 105 IF set=1240 AND RND>.95 THEN PRINT "The dog awoke and killed you !": GO TO
9000
 107 GO SUB 500: PRINT INK 6;a$;" ";b$
 110 IF a$="n" AND no THEN LET set=no: GO TO 20
 120 IF a$="s" AND so THEN LET set=so: GO TO 20
 130 IF a$="w" AND we THEN LET set=we: GO TO 20
 140 IF a$="e" AND ea THEN LET set=ea: GO TO 20
 150 IF a$="d" AND do THEN LET set=do: GO TO 20
 155 IF a$="u" THEN GO TO 6100
 160 IF a$="r" THEN GO TO 40
 170 IF a$="help" THEN PRINT "No Chance !": GO TO 100
 180 IF a$="take" OR a$="get" THEN GO TO 2000
 190 IF a$="put" OR a$="drop" THEN GO TO 4500
 200 IF a$="open" THEN GO TO 2500
 205 IF a$="feed" THEN GO TO 3500
 210 IF a$="look" THEN GO TO 60
 215 IF a$="swim" THEN GO TO 4000
 220 IF a$="break" OR a$="smash" THEN GO TO 6000
 225 IF a$="light" THEN GO TO 7500
 230 IF a$="read" THEN GO TO 6500
 240 IF a$="unlock" THEN GO TO 3000
 250 IF a$="i" THEN GO SUB 5500: GO TO 100
 260 IF a$="insert" THEN GO TO 7000
 275 IF a$="quit" THEN GO TO 9000
 280 IF a$="save" THEN SAVE "TimeSwitch" LINE 20: PRINT "Verify": VERIFY "": GO
TO 100
 490 IF LEN a$=1 THEN PRINT "I can't !": GO TO 100
 499 PRINT "I can't ";a$;" ";b$;" !": GO TO 100
 500 IF i$(1)=" " AND LEN i$>1 THEN LET i$=i$(2 TO ): GO TO 500
 502 LET sp=0: LET a$="": LET b$="": FOR n=1 TO LEN i$
 505 IF i$(n)=" " AND NOT sp THEN LET sp=1: GO TO 520
 510 IF NOT sp THEN LET a$=a$+i$(n)
 515 IF sp THEN LET b$=b$+i$(n)
 520 NEXT n
 530 RETURN
1000 LET l$="You are in a forest. There are  paths leading north and south."
1010 LET no=1390: LET so=1030
1020 RETURN
1030 LET l$="You are in a forest, with paths leading north and east and a    cle
aring to the west."
1040 LET no=1000: LET ea=1090: LET we=1060
1050 RETURN
1060 LET l$="You are in a clearing. In the   centre is a time machine, which lac
ks a power source. Exit east."
1070 LET ea=1030
1080 RETURN
1090 LET l$="You are in the forest. There is a path running east-west."
1100 LET we=1030: LET ea=1120
1110 RETURN
1120 LET l$="You are in the forest. Through  a gap to the north you can see  a l
ake. The path runs east-west and there is a cave to the      south."
1130 LET ea=1300: LET we=1090: LET so=1150
1140 RETURN
1150 LET l$="You are in a small cave.        Daylight is to the north. There is
a door to the west and an    opening to the south."
1160 LET so=1180: LET no=1120
1170 RETURN
1180 LET l$="You are in a large cavern. Thereis a chest lying in one corner, and
 a skeleton in another. The  only exit is to the north."
1190 LET no=1150
1200 RETURN
1210 LET l$="I can't see a thing !"
1220 LET up=1150
1230 RETURN
1240 LET l$="You are in a long passage. You  can hear the sound of dripping  wat
er. To the north is a stair  with a large dog sleeping on thebottom step."
1250 LET so=1210
1260 RETURN
1270 LET l$="You are on an island in the      centre of the lake. There is a  hol
e in the ground with a stair in it."
1280 LET do=1240
1290 RETURN
1300 LET l$="You are beside a lake. There is an island in the middle of the  lak
e. To the west is the forest and to the north is a rockery."
1310 LET no=1330: LET we=1120
1320 RETURN
1330 LET l$="You are in a rockery. The lake  is to the west, and there are   som
e reeds to the north. Exits  are south and north."
1340 LET no=1360: LET so=1300
1350 RETURN
1360 CLS : PRINT "I have just fallen into a swamp. Glug. Glug.. Glug......": GO
TO 9000
1390 LET l$="You are in a shrubbery. The lakeis to the east. The forest is tothe
 south, and meadow is to the north."
1400 LET no=1420: LET so=1000
1410 RETURN
1420 LET l$="You are in a meadow. The lake   is to the south-east. To the    sou
th is the shrubbery and to   the east is a tower."
1430 LET ea=1450: LET so=1390
1440 RETURN
1450 LET l$="You are at the foot of a tower. There is no door to be seen. To the
 west is the meadow and to   the east are some reeds."
1460 LET we=1420: LET ea=1360: LET up=1480
1470 RETURN
1480 LET l$="You are at the top of the tower.To the south you can see the    lak
e with the island in the     centre and the forest beyond.   In the centre of th
e platform   is a glass case with a golden   key inside."
1490 LET do=1450
1500 RETURN
2000 IF i>=5 THEN PRINT "I can't carry any more !": GO TO 100
2002 IF b$="" THEN PRINT a$;" what ??": GO TO 100
2005 LET found=0: FOR n=1 TO 12: IF o$(n)=(b$+"                ")( TO 11) AND l(n)=se
t AND i<5 THEN PRINT "OK..": LET found=1: LET l(n)=0: LET i=i+1
2010 NEXT n
2020 IF NOT found THEN GO TO 499
2030 GO TO 100
2500 IF b$="" THEN INPUT "Open what ?:"; LINE b$: GO TO 2500
2505 IF b$="door" AND set<>1150 THEN PRINT "What door ?": GO TO 100
2507 IF b$="door" AND NOT und THEN PRINT "It's locked dumbo !": GO TO 100
2510 IF b$="door" THEN PRINT "There is a stair going down.": LET do=1210: GO TO
100
2515 IF b$="chest" AND set<>1180 THEN PRINT "I see no chest !": GO TO 100
2517 IF b$="chest" AND NOT unc THEN PRINT "It's locked !": GO TO 100
2520 IF b$="chest" THEN PRINT "OK": LET l(11)=set: GO TO 100
2530 GO TO 499
3000 IF b$="" THEN INPUT "Unlock what ?:"; LINE b$: GO TO 3000
3005 IF b$="door" AND set<>1150 THEN PRINT "What door ?": GO TO 100
3007 IF l(7) THEN GO TO 499
3010 IF b$="door" THEN LET und=1: PRINT "Click !": GO TO 100
3015 IF b$="chest" AND set<>1180 THEN PRINT "What chest ?": GO TO 100
3020 IF b$="chest" THEN LET unc=1: PRINT "Clunk !": GO TO 100
3030 GO TO 499
3500 IF b$="" THEN INPUT "Feed what ?:"; LINE b$: GO TO 3500
3510 IF b$<>"dog" THEN PRINT "Don't be silly !": GO TO 499
3520 IF set<>1240 THEN PRINT "There's no dog here !": GO TO 100
```

SLIDER

Colin Carruthers illustrates the dangers of spatio-temporal vortices to Spectrum Time Lords.

YOUR CLOSE encounter with a spatio-temporal anomaly has left you stranded in an alien land, thousands of years out of sync with your own time segment. Not only that, but you have forgotten where you parked your time machine. The object of the game is to find your way back to your own time.

When writing the game the first problem encountered was how to represent the various locations used in the program. Each location requires a description, a list of objects to be found at that location and a list of the surrounding locations and their directions.

The solution was to give each location a subroutine, where the description of the surroundings and pointers to the neighbouring locations are set. We decided that the objects would best be represented by two arrays, the first string array holding the description of each object and the second numeric array holding a pointer to the location of each object. A pointer value of zero indicates that that particular object is being carried.

The command decoder converts the input string into lower case, and splits the string into command and parameter. This allows input to both upper and lower case.

The game is played by typing in direct commands with verbs followed by nouns, for example:

GET ROPE

Some of the other commands recognised are n for north, s for south, e for east, w for west, u for up and d for down. In addition, there are a number of special commands. These include: Save, which saves the current game; I, which is short for inventory, gives a list of all objects being carried; and R which is short for recap, clears the screen and repeats the description of the surroundings. Quit exits from the current game and asks if you want another try.

Once you have typed the program in, Save it by typing

GO TO 9990

This will automatically verify the recording. Anyone who is completely stuck may send for a special map to ease their frustration. These are available from Colin Carruthers at 22 Drylaw House Gardens, Edinburgh EH4 2UE. Please enclose a stamped addressed envelope and a cheque/postal order for 50p.

Table 2. Program breakdown

10-15	Initial set-up sequence
20-499	Main loop
500-530	Command decoder
1000-1500	Location Subroutines
2000-2030	Get/Take Subroutine
2500-2530	Open Subroutine
3000-3030	Unlock Subroutine
3500-3550	Feed Subroutine
4000-4010	Swim Subroutine
4500-4530	Drop Subroutine
5000-5080	Initialisation
5500-5550	Inventory Subroutine
6000-6030	Smash Subroutine
6100-6220	Up Subroutine
6500-6540	Read Subroutine
7000-7010	Game Over
7500-7530	Light Subroutine
8000-8500	Titles
9000-9020	Another Game?
9990	Save/Verify

```
3530 IF l(12) THEN PRINT "I have no dog food !": GO TO 100
3540 LET i=i-1: LET fed=1: LET up=1270: PRINT "Munch, munch !": LET l(12)=1180:
GO TO 100
3550 GO TO 499
4000 IF set=1120 OR set=1270 OR set=1300 OR set=1330 OR set=1390 OR set=1420 THE
N PRINT "Brr. The water is too cold !": GO TO 100
4010 PRINT "There is no water here !": GO TO 100
4500 LET found=0: FOR n=1 TO 12: IF o$(n)=(b$+"           ")( TO 11) AND l(n)=0
THEN PRINT "OK..": LET found=1: LET l(n)=set: LET i=i-1
4502 IF b$="" THEN PRINT a$;" what ??": GO TO 100
4510 NEXT n
4520 IF NOT found THEN PRINT "I don't have ";b$;" !"
4530 GO TO 100
5000 LET und=0: LET unc=0
5010 DIM o$(12,11): DIM l(13)
5020 RESTORE 5030
5030 DATA "rope",1330,"rock",1330,"ladder",1300,"gold ring",1090,"gun",1390,"13
Amp Plug",1420
5035 DATA "golden key",1,"torch",1150,"battery",1270,"log",1270,"manuscript",1,"
bone",1180
5040 FOR n=1 TO 12: READ o$(n),l(n): NEXT n
5080 RETURN
5500 LET found=0: FOR n=1 TO 12: IF l(n)<>0 THEN NEXT n: GO TO 5540
5510 IF NOT found THEN PRINT "I have the following...": LET found=1
5520 PRINT "a ";o$(n)
5530 NEXT n
5540 IF NOT found THEN PRINT "I don't have anything !"
5550 RETURN
6000 IF b$="" THEN INPUT (a$);" what ?:"; LINE b$: GO TO 6000
6010 IF b$<>"glass" OR set<>1400 THEN GO TO 499
6020 IF l(2) THEN PRINT "Nothing to ";a$;" it with !": GO TO 100
6030 PRINT "Smash ! Tinkle !": LET i=i-1: LET l(7)=set: LET l(2)=set: GO TO 100
6100 IF set=1240 THEN GO TO 6200
6105 IF set<>1450 AND up THEN LET set=up: GO TO 20
6110 IF l(3) THEN PRINT "There's no way up !": GO TO 100
6120 IF up THEN LET set=up: GO TO 20
6130 PRINT "I can't go up !": GO TO 100
6200 IF NOT fed THEN PRINT "There's a dog in the way !": GO TO 100
6210 LET set=1270: GO TO 20
6220 GO TO 499
6500 IF b$="" THEN INPUT "Read what ?:"; LINE b$: GO TO 6500
6510 IF b$<>"manuscript" THEN GO TO 499
6520 IF l(11) THEN PRINT "I do not have ";b$: GO TO 100
6530 PRINT "It say's: PP3-TM Island ?": GO TO 100
6540 GO TO 499
7000 IF l(9) OR set<>1060 THEN GO TO 499
7010 PRINT '"You have successfully completed  the adventure.": GO TO 9000
7500 IF b$="" THEN INPUT "Light what ?:"; LINE b$: GO TO 7500
7510 IF l(8) THEN GO TO 499
7520 IF set=1210 THEN LET no=1240: LET l$="You are in a small room. There  is a
staircase to the east and  a damp passage to the north.": GO TO 40
7530 PRINT "That didn't do much good.": GO TO 100
8000 CLS : PRINT ''''"     T I M E   S W I T C H               ========================
="
8010 PRINT '''" You are stranded in the dim      and distant past. You must find
your way back to your own time."
8020 PRINT ''''"     Press any key to start.": PAUSE 0
8030 FOR n=0 TO -10 STEP -1: BEEP .05,n: NEXT n
8500 RETURN
9000 INPUT "Do you want to try again ?:"; LINE a$
9010 IF a$="y" THEN RUN
9020 STOP
9990 CLEAR : SAVE "TimeSwitch" LINE 10: PRINT "Verify..": VERIFY "": PRINT "OK":
 STOP
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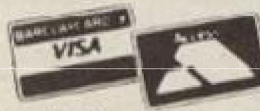
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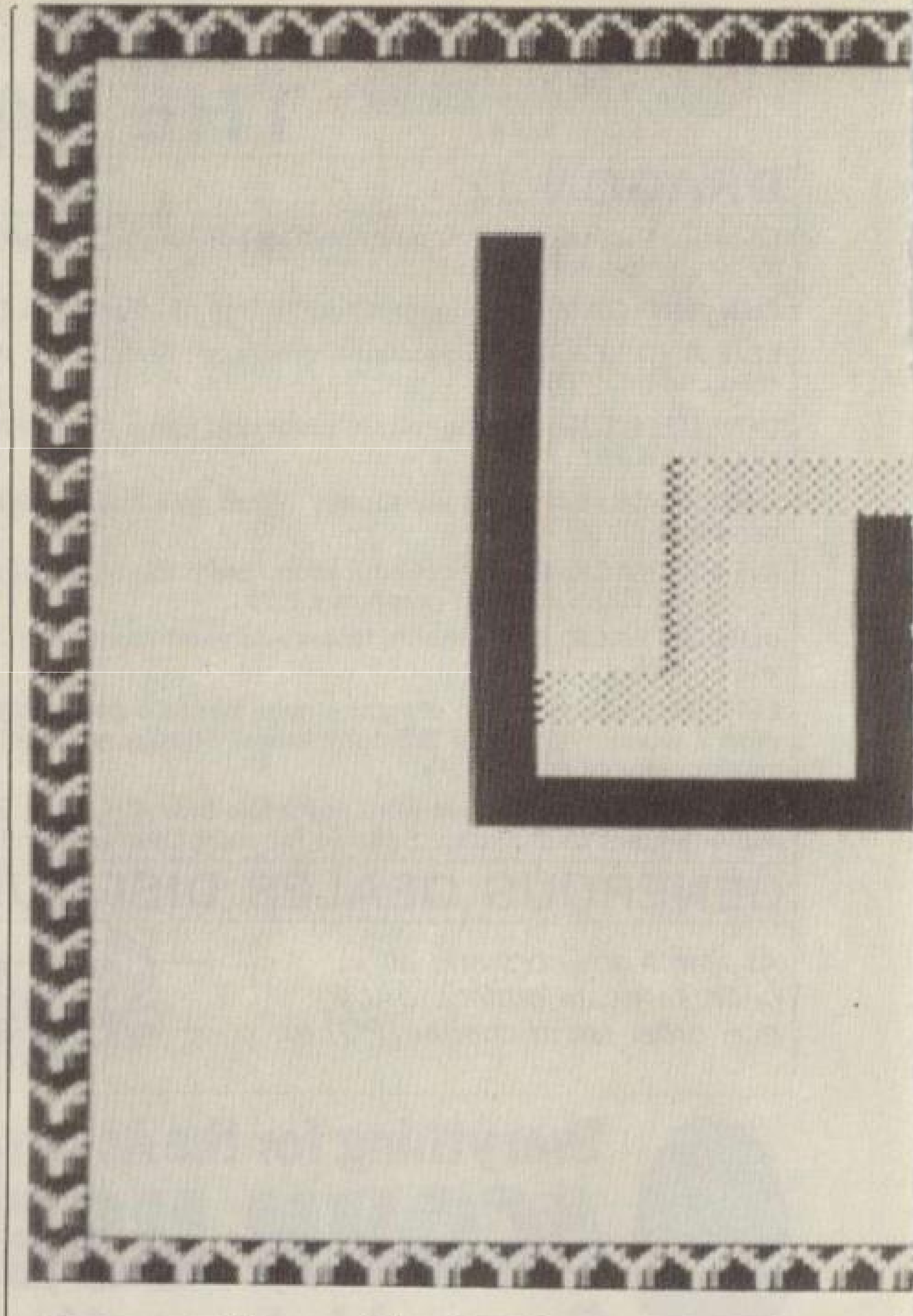
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Figure 1. Decimal Loader.

```
10 REM AT LEAST 596
CHARS
20 FOR N=16514 TO 17110
30 INPUT B
40 SCROLL
50 PRINT N,B
60 POKE N,B
70 NEXT N
```

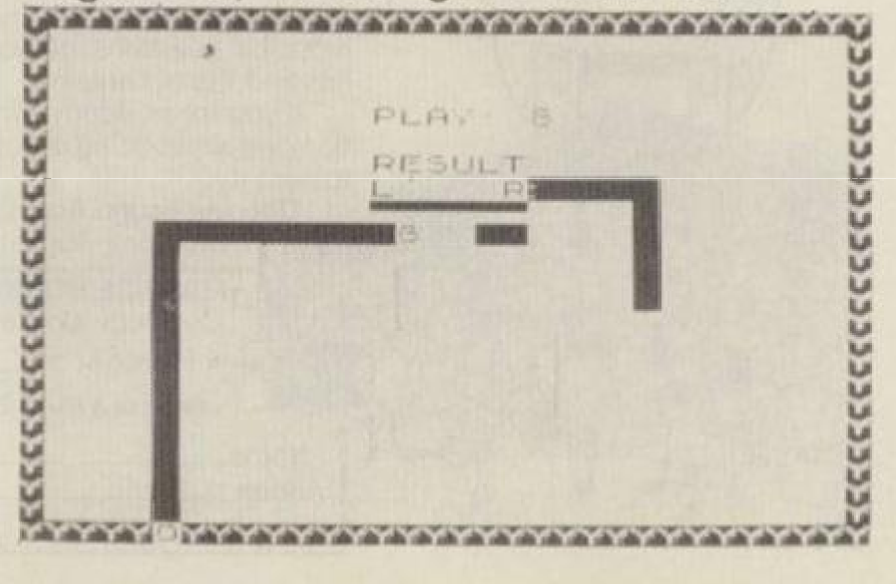
Figure 3. Main listing.

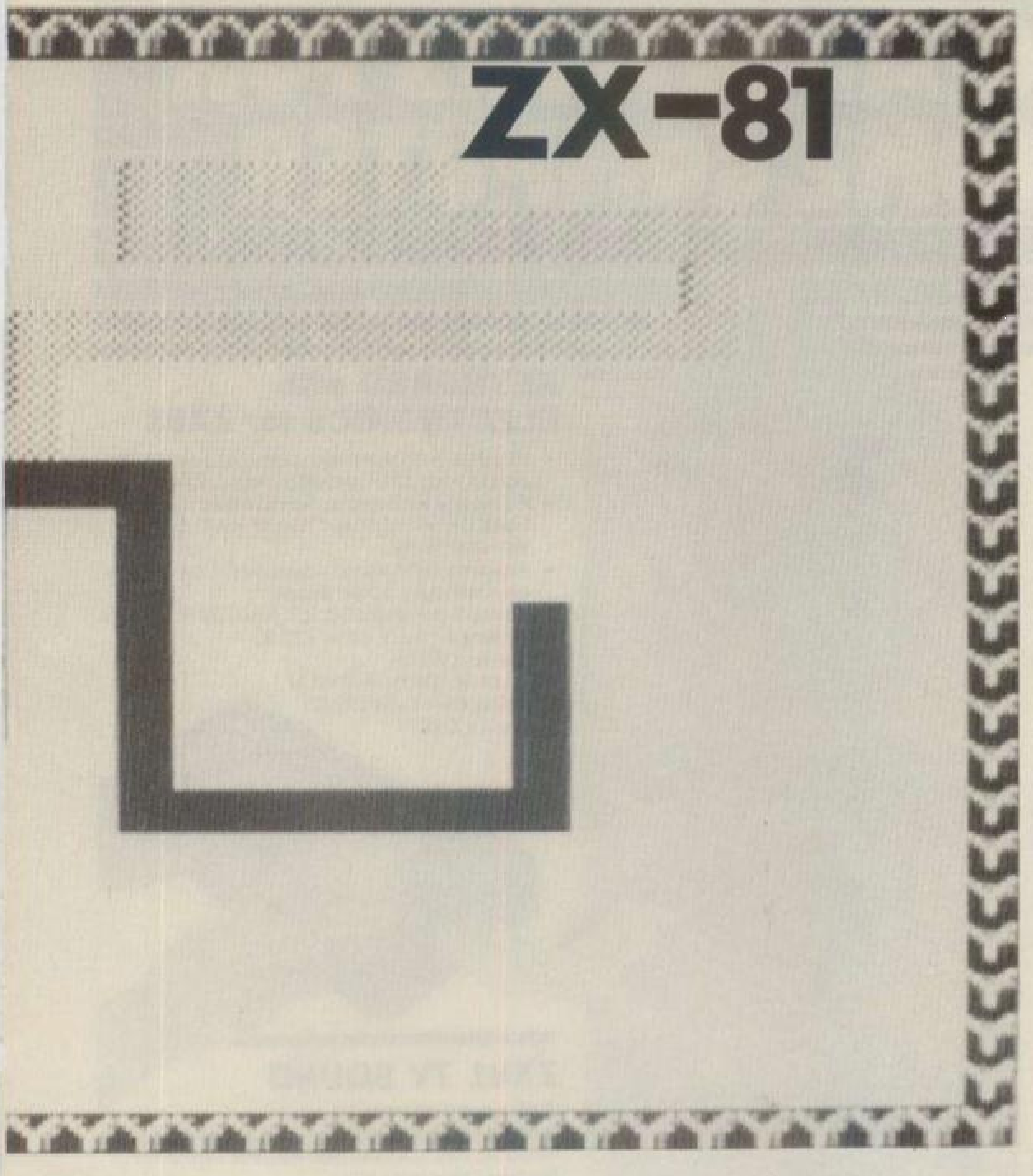
```
  10█LET L=0
  30 CLS
  40 PRINT AT 0,0;"██████████████DEATH
█████████████████████"
  60 GOSUB 500
  70 IF INKEY$="Y" THEN GOTO 250
  80 IF INKEY$<>"N" THEN GOTO 70
  90 RAND USR 16514
 100 LET L=L+1
 110 POKE 16418,0
 120 PRINT AT 4,13;"PLAY:  ";L;AT
 6,13;"RESULT";AT 7,13;"L      R";
AT 8,13;"██████████";AT 9,13;"█";USR
 17015;"   ";USR 17024;"█";AT 10,
13;"██████████";AT 17,4;"SHALL I CON
TINUE ? (Y/N)"
 130 IF USR 17015=10 OR USR 1702
4=10 THEN GOTO 190
 140 IF INKEY$="Y" THEN GOTO 170
 150 IF INKEY$="N" THEN GOTO 190
 160 GOTO 140
 170 RAND USR 16530
 180 GOTO 100
 190 PRINT AT 23,7;" ANOTHER GO
? (Y/N) "
 200 FOR F=1 TO 40
 210 NEXT F
 220 IF INKEY$="Y" THEN GOTO 10
 230 IF INKEY$="N" THEN STOP
 240 GOTO 220
 250 PRINT AT 0,0;" PUT IN 1,2,3
 OR 4 FOR POSITION. "
 260 POKE 16418,2
 270 DIM A(3)
 280 LET A(1)=17096
 290 LET A(2)=16652
 300 LET A(3)=17098
 310 FOR F=1 TO 40
 315 NEXT F
 320 IF INKEY$="" THEN GOTO 320
 330 IF INKEY$="N" THEN GOTO 90
 335 PRINT AT 13,0;"
                         "
 337 PRINT AT 20,0;"POSITION ?(1
2,3 OR 4)         "
 340 INPUT I
 350 IF I>4 THEN GOTO 340
 360 IF I<>4 THEN GOTO 420
 370 PRINT AT 20,0;"PUT IN A CHA
RACTER OF PAPER.  "
 380 INPUT A$
 390 IF CODE A$>=64 AND (CODE A$
<128 OR CODE A$>191) THEN GOTO 3
80
 400 POKE 17100,CODE A$
 410 GOTO 460
 420 PRINT AT 20,0;"CHANG ?(FROM
 0 TO 255)"
 430 INPUT II
 440 IF II>255 THEN GOTO 430
 450 POKE A(I),256-II-256*(II=0)
 460 GOSUB 500
 470 FOR F=1 TO 40
 480 NEXT F
 490 GOTO 250
 500 PRINT AT 3,0;"(1) INITIAL S
PEED= ";256-PEEK 17096-256*(PEEK
 17096=0);"  ";AT 5,0;"(2)   FIN
AL SPEED= ";256-PEEK 16652-256*(
PEEK 16652=0);"  ";AT 7,0;"(3)
ACCELERATION= ";256-PEEK 17098-2
56*(PEEK 17098=0);"  ";AT 9,0;"(
4)         PAPER= """;CHR$ PEEK
17100;""""
 505 PRINT AT 13,0;"SHALL I  CHA
NGE ANYTHING ? (Y/N)       PRESS
""N"" FOR PLAY."
 507 PRINT AT 20,0;"
                         "
 510 RETURN
 520 SAVE "TIS DUE█"
 530 RUN
```



ZX DEA

By special request, all the way from Yugoslavia, Tavcar Igor's Death Duel.





ATH DUEL

DEATH DUEL is a version for the 16K ZX-81 of the highly successful Spectrum game published last April. Written in machine code it improves on the Spectrum game by giving a choice of speed and acceleration.

Two people play at the same time. The players race around the screen leaving a trail behind them. Your object is to drive your opponent to crash either into your trail or his own. Steer clear of the border — that's fatal.

Before battle commences you can change the speed and acceleration and set the background character for the playing area. During play press T to freeze the action and B to return to Basic. Pressing Y will turn the acceleration on; N will turn if off. The border character shows which option has been chosen.

To enter the program create a Rem statement in line 1 with at least 596 characters. If you are typing it from the keyboard — rather than using a program to create it — use Fast mode and remember that the first line contains 26 and each full line 32 characters thereafter.

Now type in the decimal loader in figure 1 as lines 20 to 70, after the Rem statement. Run the program to enter the decimal code in figure 2. Press Newline after you have entered each number.

Once all the code has been Poked into the Rem statement enter Stop to stop the loader, delete the lines 20 to 70 and type in the program in figure 3, again leaving the Rem statement in place. The program is now ready to run but should be saved first. ■

Use the following keys to steer:

Left Player	Right Player
1 — Up	0 — Up
Q — Down	P — Down
D — Right	N/L — Right
A — Left	K — Left

Figure 2. Decimal code.

```
16514-58 200 66 50 199
16519-66 33 195 66 54
16524-0 33 197 66 54
16529-0 205 133 66 58
16534-204 66 6 22 14
16539-30 35 119 13 32
16544-251 22 0 35 21
16549-32 252 16 241 42
16554-12 64 6 12 14
16559-33 35 13 32 252
16564-16 248 6 9 35
16569-16 253 34 189 66
16574-64 136 6 15 35
16579-16 253 34 191 66
16584-64 128 62 2 50
16589-193 66 50 194 66
16594-58 202 66 50 201
16599-66 205 205 66 58
16604-203 66 254 0 40
16609-7 62 0 50 203
16614-66 24 5 62 1
16619-50 203 66 58 188
16624-66 254 179 40 32
16629-58 201 66 61 50
16634-201 66 32 23 58
16639-202 66 50 201 66
16644-58 199 66 61 50
16649-199 66 254 16 32
16654-6 58 200 66 50
16659-199 66 58 199 66
16664-58 199 66 13 32
16669-253 61 32 250 205
16674-59 65 205 67 65
16679-205 75 65 205 63
16684-65 205 103 65 205
16689-111 65 205 119 65
16694-206 127 65 24 88
16699-6 253 22 126 30
16704-1 24 22 6 253
16709-22 123 30 2 24
16714-14 6 251 22 126
16719-30 3 24 6 6
16724-247 22 126 30 4
16729-14 0 237 120 176
16734-186 40 1 201 123
16739-50 193 66 201 6
16744-191 22 126 30 1
16749-24 22 6 191 22
16754-123 30 2 24 14
16759-6 223 22 126 30
16764-3 24 6 6 239
16769-22 126 30 4 14
16774-0 237 120 176 186
16779-40 1 201 123 50
16784-194 66 201 6 251
16789-22 111 14 0 237
16794-120 176 186 32 5
16799-205 205 66 24 239
16804-6 127 22 111 14
16809-0 237 120 176 186
16814-200 6 223 22 111
16819-14 0 237 120 176
16824-186 32 11 62 190
16829-50 188 66 205 133
16834-66 205 205 66 6
16839-127 22 119 14 0
16844-237 120 176 186 32
16849-11 62 179 50 188
16854-66 205 133 66 205
16859-205 66 58 203 66
16864-254 0 32 22 42
16869-189 66 58 193 66
16874-254 1 40 34 254
16879-2 40 33 254 3
16884-40 32 254 4 40
16889-35 42 191 66 58
16894-194 66 254 1 40
16899-53 254 2 40 52
16904-254 3 40 51 254
16909-4 40 54 43 24
16914-15 35 24 12 6
16919-33 35 15 253 24
16924-5 6 33 43 16
16929-253 34 189 66 30
16934-1 58 204 66 190
16939-32 53 54 136 58
16944-203 66 254 0 40
16949-196 195 238 64 35
16954-24 15 43 24 12
16959-6 33 35 16 253
16964-24 5 6 33 43
16969-16 253 34 191 66
16974-30 2 58 204 66
16979-190 32 12 54 128
16984-58 203 66 254 0
16989-202 238 64 24 130
16994-6 0 62 0 119
16999-60 254 53 32 250
17004-16 246 123 254 1
17009-40 9 33 195 66
17014-52 237 75 195 66
17019-201 33 197 66 52
17024-237 75 197 66 201
17029-33 34 64 54 0
17034-42 12 64 6 32
17039-35 56 188 66 119
17044-16 249 6 23 14
17049-33 13 35 32 252
17054-56 188 66 119 16
17059-244 6 31 43 56
17064-188 66 119 16 249
17069-6 22 14 33 13
17074-43 32 252 56 188
17079-66 119 16 244 201
17084-190 131 76 134 76
17089-2 2 1 0 2
17094-0 46 56 6 6
17099-1 0 6 0 14
17104-0 13 32 253 16
17109-249 201
```

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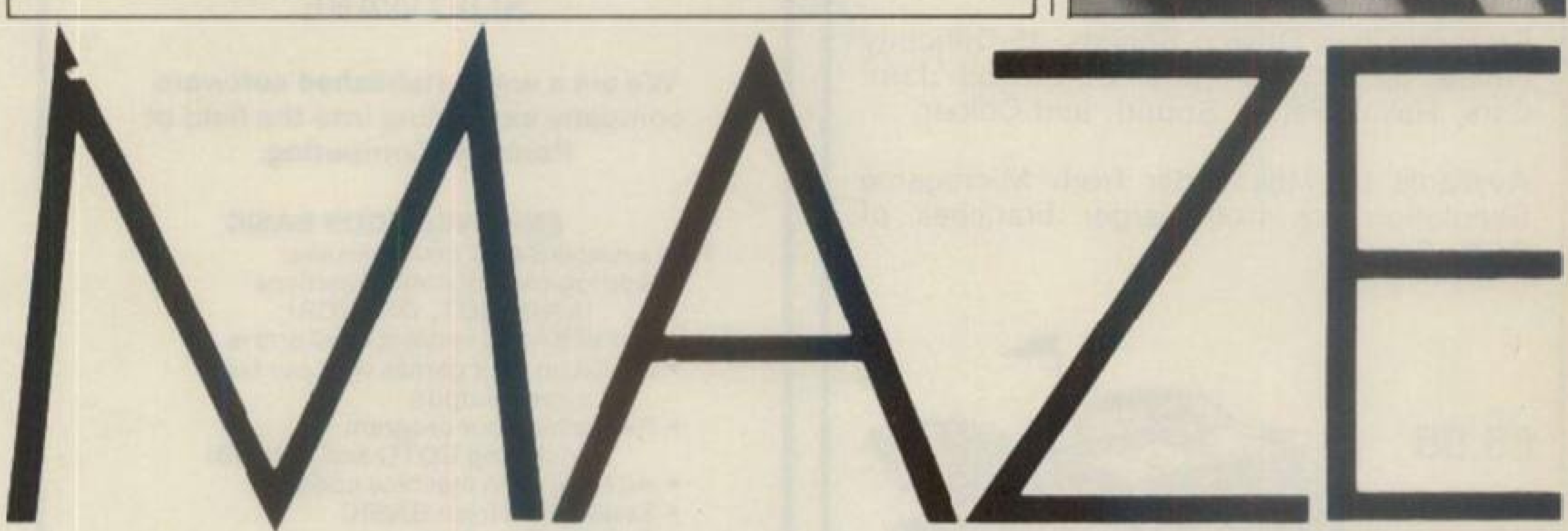
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DRAGON



Main listing.
For £ read hash character.

```
4 CLEAR500,32250
5 HS=0
6 DIMG(4,2)
10 CLS
15 PRINT"  USE THE RED BUTTON FOR RANDOM"," JUMPS- UP
TO 3 PER GAME":PRINT
20 INPUT "DO YOU WANT GHOSTS TO GO THROUGH WALLS? (Y,N
 OR S)";Q$
30 'PRINT MAZE
40 SCREEN0,1:CLS0
50 SC=0
60 L=3
70 PRINT@0,SC
80 FORA=6 TO510
90 IFRND(10)<4THENPRINT@A,CHR$(128); ELSEPRINT@A,"£";
100 NEXTA
110 PRINT@29,"L";L;
112 RC=3:PRINT@480,"R";RC;
115 EXEC 32283: REM STORE WALLS
120 'POWER PILLS PLACING
130 FORP=1TO10
140 PR=RND(510)
150 PY=INT(PR/32):PX=PR-(PY*32)
160 IFPOINT(PX*2,PY*2)<>-1 OR PR<6 OR (PR>28 AND PR<32
) OR PR>479THEN140 ELSE 170
170 PRINT@PR,CHR$(239);
180 NEXTP
190 'GHOST PLACING
210 FORGH=1TO4:
220 GR=RND(510)
240 GY=INT(GR/32):GX=GR-(GY*32):IF GX>30 OR GX<1 THEN
220
250 IF GY<1 OR GY>14 THEN 220
280 G(GH,1)=GX:G(GH,2)=GY
290 IF POINT(GX*2,GY*2)=-1 THEN 300 ELSE 220
300 PRINT@GR,CHR$(255);
310 NEXTGH
320 PRINT@510,CHR$(175);
330 MX=30:MY=15
340 'MOVE YOUR MAN
```




```
345 LC=LC+1
350 OX=MX:OY=MY
360 PRINT@MY*32+MX,CHR$(143);
370 IH=JOYSTK(0):IV=JOYSTK(1)
375 MY=MY+(IV<27 AND MY>0)
380 MY=MY-(IV>37 AND MY<15)
390 MX=MX+(IH<27 AND MX>0)
400 MX=MX-(IH>37 AND MX<31)
401 PE=PEEK(65280):IF PE = 126 OR PE=254 THEN GOSUB150
0
```

(listing continued on page 73)

A DIFFERENT, random maze every game; three random jumps per game, to get you out of tight corners; facility to choose at the start of the game whether the ghosts can pass through the walls. What more could you want?

This maze makes extensive use of colour and should really be played on a colour TV for maximum enjoyment. The game is written for a joystick connected to the right-hand port, and the button gives the random jump. The

(continued on page 73)

```
DECIMAL LISTING FOR MACHINE CODE
 32256   142  6  0  16  142  4  0  166
 32264   128  140  7  255  39  12  129  128
 32272   39  4  230  160  32  241  167  160
 32280   32  237  57  142  4  0  16  142
 32288   6  0  166  128  167  160  140  5
 32296   255  39  2  32  245  57  142  4
 32304   0  198  99  166  128  140  5  255
 32312   39  12  166  132  129  255  38  2
 32320   231  132  166  128  32  239  57  0
MODIFICATIONS TO GNASH MAZE FOR
KEYBOARD OPERATION
 370 I$=INKEY$
 375 IF I$="↑" AND MY>0 THEN MY=MY-1
 380 IF I$=CHR$(10) AND MY<15 THEN MY=MY+1
 390 IF I$=CHR$(8) AND MX>0 THEN MX=MX-1
 400 IF I$=CHR$(9) AND MX<31 THEN MX=MX+1
 401 IF I$="R" THEN GOSUB 1500
 402 I$=""
 510 IF LC<TI THEN 640
 10 FOR N=32256 TO 32328
 20 READ A:POKE N,A
 30 NEXT
 40 DATA 142,6,0,16,ETC
 50 DATA 128,140,7,ETC
 60 ENTER REST OF MACHINE CODE AS ABOVE
```

DRAGON

(continued from page 71)

score is at top left, and the number of lives, initially three, at top right. You start at lower right, and return there for a new life if the ghosts get you. When you eat a purple pill, the ghosts freeze for a random time of less than five seconds and you can get them, for 500 points. Purple pills count 100, and flowers 10 points.

A version for keyboard is also included, in which case R gives the random jump. The arrow keys move your man. You can also remove the delay in line 510, without which the joystick is almost impossible to use.

The program uses some small machine-code routines, mainly to clean up ghost damage to the maze, and these should be loaded to addresses 32256 onwards, using a data statement to Poke the codes to the addresses shown.

CLEAR200,32256

before doing this. Then save this machine code to tape, and clear your Basic loader from memory. Load the Basic program for the game and also save this to tape. On subsequent occasions type

CLEAR200,32256

then CloadM, then Cload and finally Run. Good hunting! For a faster game, type

POKE&HFFD7,0

■

(listing continued from page 71)

```
405 IF POINT(MX*2,MY*2)=0 OR POINT(MX*2,OY*2)=0 OR POI
NT(OX*2,MY*2)=0 THEN MX=OX:MY=OY:PRINT@MY*32+MX,CHR$(1
75);:GOTO340
410 IFPOINT(MX*2,MY*2)=-1 AND (MY*32+MX)>6 AND POINT(M
X*2,OY*2)<>0 AND POINT(OX*2,MY*2)<>0 THEN SC=SC+10
420 IFPOINT(MX*2,MY*2)=7 AND POINT(MX*2,OY*2)<>0 AND P
OINT(OX*2,MY*2)<>0 THENSC=SC+100:GOSUB650
430 IFPOINT(MX*2,MY*2)=8 ANDPOINT(MX*2,OY*2)<>0 AND PO
INT(OX*2,MY*2)<>0 THEN GOSUB700
440 IFPOINT(MX*2,MY*2)=2 AND POINT(MX*2,OY*2)<>0 AND P
OINT(OX*2,MY*2)<>0 THEN SC=SC+500
460 IF LC>TI THEN GOSUB 750
470 PRINT@MY*32+MX,CHR$(175);
490 PRINT@0,SC;
500 'MOVE GHOSTS
510 IF LC<TI THEN FOR D=1 TO 110:NEXTD:GOTO 640
520 FORGH=1TO4
530 'STORES OLD GHOST POSNS
540 HY=G(GH,2):HX=G(GH,1)
550 R=INT(RND(0)+.5)
560 GX=G(GH,1):GY=G(GH,2)
570 IF GY<14 THENGY=GY-R*(GY<MY)
580 IF GY>1 THEN GY=GY+R*(GY>MY)
585 PO=POINT(GX*2,GY*2)
586 ONPO+2 GOSUB 970,890,970,800,820,800,800,800,800,8
00
587 R=INT(RND(0)+.5)
588 HY=GY
590 IF GX<30 THEN GX=GX-R*(GX<MX)
600 IF GX>1 THEN GX=GX+R*(GX>MX)
610 PO=POINT(GX*2,GY*2)
620 ON PO+2 GOSUB 970,890,970,800,820,800,800,800,800,
800
621 HX=GX
625 NEXT GH
630 EXEC 32302
631 FORGH=1 TO 4:PRINT@G(GH,1)+32*G(GH,2),CHR$(255);:N
EXT GH
635 EXEC 32256:REM REPRINT WALLS
640 GOTO340
650 LC=0:REM LOOP CTR
652 TI=RND(25)+25
655 FL=0:REM GHOST REPLOT FLAG
660 FORGH=1TO4:GX=G(GH,1):GY=G(GH,2)
670 PRINT@GY*32+GX,CHR$(159);
680 NEXTGH
690 RETURN
700 L=L-1:MX=30:MY=15:PRINT@30,L;
710 IFL=0THENGOTO2000
720 FORN=25 TO 10 STEP-1:SOUNDN,1:NEXTN
730 RETURN
740 RETURN
750 'RESET GHOSTS
755 IF FL=1 THEN RETURN
760 FORGH=1 TO 4:GX=G(GH,1):GY=G(GH,2)
770 PRINT@GY*32+GX,CHR$(255);
780 NEXTGH
785 FL=1:REM SET REPLOT FLAG
790 RETURN
800 GX=HX:GY=HY
805 G(GH,2)=GY:G(GH,1)=GX
810 RETURN
820 'GHOSTS GET THEIR MAN
830 FOR N=1 TO 10:SOUNDN,1:NEXTN
840 L=L-1:PRINT@29,"L";L;
850 IFL=0THENGOTO2000
860 PRINT@MY*32+MX,CHR$(143);
865 G(GH,1)=MX:G(GH,2)=MY
870 MX=30:MY=15
880 RETURN
890 IF Q$="S" AND RND(0)<.5 THENGX=HX:GY=HY:G(GH,1)=GX
:G(GH,2)=GY: RETURN
900 IFQ$="N"THEN GX=HX:GY=HY:G(GH,1)=GX:G(GH,2)=GY:RET
URN
910 G(GH,1)=GX:G(GH,2)=GY
920 IFPOINT(HX*2,HY*2)=0 THEN PRINT@ HY*32+HX,CHR$(128
); ELSE PRINT@HY*32+HX,CHR$(35);
930 RETURN
960 IF Q$="N"THEN RETURN
970 PRINT@HY*32+HX,CHR$(35);
980 G(GH,1)=GX:G(GH,2)=GY
990 RETURN
1500 RC=RC-1:PRINT@480,"R";(RC AND RC>-1);:IFRC<0 THEN
 RETURN
1510 R=RND(510)
1520 EY=INT(R/32):EX=R-(EY*32)
1530 IFPOINT(EX*2,EY*2)<>-1 THEN 1510
1540 MY=EY:MX=EX:PRINT@MY*32+MX,CHR$(175);:OX=MX:OY=MY
1550 RETURN
2000 IF HS<SC THEN HS=SC
2010 CLS3:PRINT"GAME OVER":PRINT:PRINT"SCORE ";SC:PRIN
T:PRINT"(RECORD ";HS;")";
2020 INPUT"ANOTHER GAME (Y OR N)";Q$
2030 IF Q$="Y"THEN 10 ELSE END
2100 REM CHANGE 587 TO AN ACTIVE LINE TO ALTER RATIO O
F X:Y GHOST MOVEMENTS. PROGRAM WILL BE A LITTLE SLOWER
```

New from ...

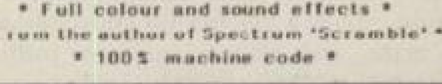
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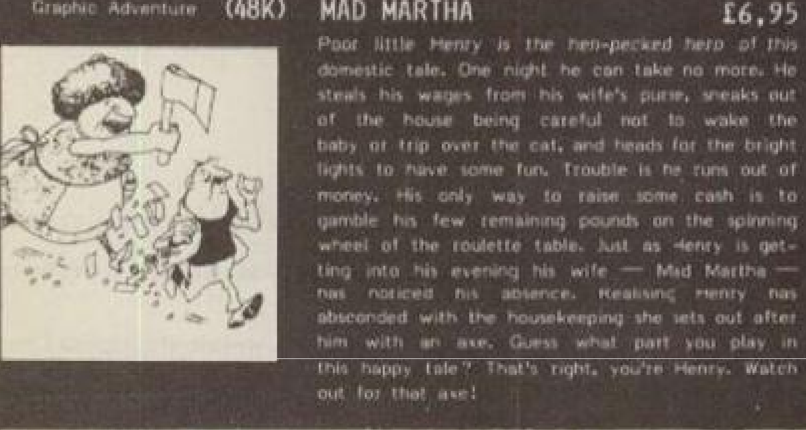
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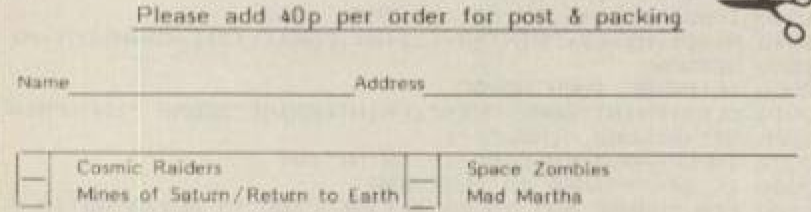
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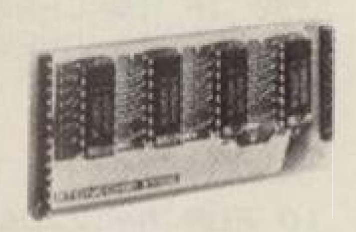
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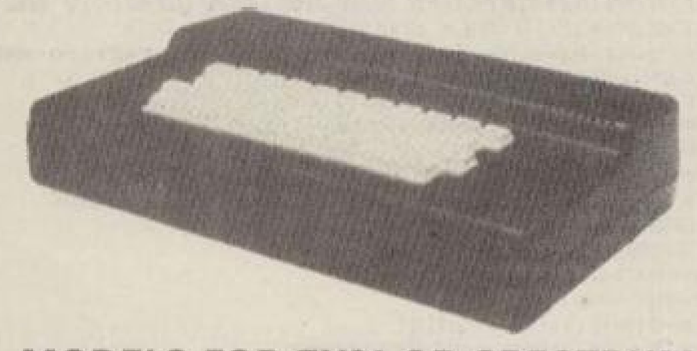
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ZX-81



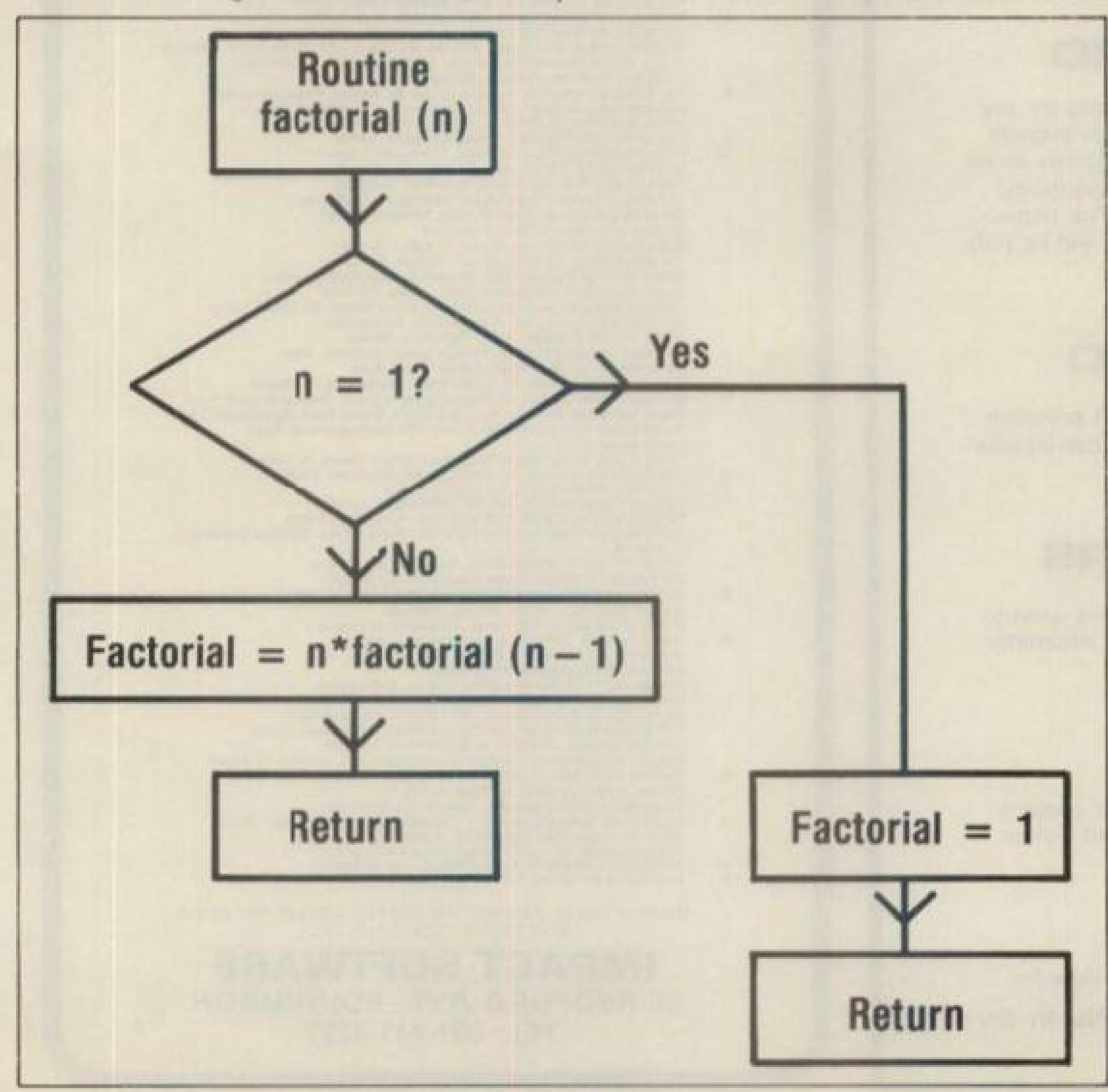
David Threlfall continues his short series with the complete machine code for ZXGT, a true compiler for the ZX-81. ZXGT is only just over 2.3K bytes. The fast code is the result of limiting the compiler to integer Basic. This month, details are given of the way that the compiler translates Basic with examples from the standard Basic repertoire.

GT COMPILER

LAST MONTH we considered the philosophy behind ZXGT, my ZX-81 Basic compiler. This month we move on to the intricacies of integer arithmetic evaluation and see how some statements compile.

For those uninitiated to Z-80 machine code here are a few preliminaries. ZXGT uses the Z-80 registers A,B,C,D,E,H and L. A is the eight-bit accumulator. H and L may be considered as a single 16-bit accumulator. All the registers may be used for eight-bit storage but the pairs BC and DE may also be used in 16-bit manipulations. Putting a register pair or 16-bit number in brackets means that the value in brackets should be taken to point to the location required. For example:

LD HL,n	load HL with the value n
but	
LD A,(HL)	means load register A with the data in the location pointed to by the value in the HL register pair.



Here are a few simple examples to start the description of the compiler.

CLS

This results in a call to Sinclair's ROM at hexadecimal address 0A2A.

RETURN

This one is very easy, requiring the Z-80 instruction Ret — return.

PEEK n

This causes HL — the double-precision accumulator — to be loaded with the contents of location n, thus:

LD HL,n	load HL with n
LD A,(HL)	load the accumulator with the contents of location HL
LD L,A	move A into L
LD H,0	zero H
	HL now contains the contents of location n.

The next example is:

ABS X

Load HL with X and test the top bit of H — the sign bit. Call a negate routine if this bit is set, that is, if the number is negative. Negating a number entails taking the 2's complement but there is no Z-80 instruction for this. Instead we must take the 1's complement of H and L independently and then increment HL.

POKE x,y

This means put the lower byte of y in location x. As we need x and y simultaneously they cannot both be in the HL register pair. Therefore we get x in HL and y in DE then do LD (HL),E as required remembering that Poke acts on only one byte.

GOTO n

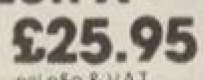
This will be translated as a Jump — JP — instruction; n must be a number and not a variable. The compiler has two passes. On the first, it generates a table of line numbers and their addresses in the machine code. On the second pass, the correct addresses will be available for both forward and backward Gotos. *(continued on page 79)*

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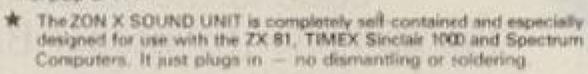




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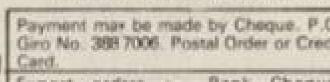
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(continued from page 77)

Note in particular that, in the compiled code, the nearness of n to the start of the program does not affect the time taken to execute the Goto.

GOSUB n

This works just like a Goto except that it results in a Call instead of a JP.

USR x

This results in the machine code at location x being executed. It looks as if it should result in just a Call to location x. However, there is no machine code statement for "call to the address given by a register pair" that is,

CALL (HL)

so subterfuge is necessary. Consider the following code:

```
LD BC,BACK   load BC with the address of
             label BACK.
PUSH BC      keep BC on the stack
LD HL,x      get x into HL
PUSH HL      and push HL on to the stack

BACK: continue code
```

The first four lines get the address of Back and the address to which we wish to go on to the stack. The Ret instruction makes the machine "return" to the address at the top of the stack which is x, just as we wanted. At the end of the routine starting at x, a Return causes a jump to the next address on the stack which is Back and there we are.

FOR-NEXT

The For-Next pair is compiled into directly executable code — not calls to other routines — and so a For-Next loop is extremely fast. The For statement has the form:

FOR K=M TO N

where M and N may be parenthesised expressions. M is moved into variable K and (N+1) is stored in the next word/two-byte location. During compilation the address of the next location after For — let us call it zzzz — is also stored. The next K statement is compiled thus:

```
LD HL,(nnnn)      where nnnn is the location
                  where variable K is stored.
INC HL            make K one bigger
LD (nnnn),HL      store this value
LD DE,(nnnn+2)    get value of end of loop
AND A             clear carry flag
SBC HL,DE         subtract DE from HL
JP M,zzzz         if HL-DE is negative jump to
                  the next address after FOR.
                  Otherwise execute the next
                  instruction.
```

This arrangement results in extremely fast execution of the final code — about 170 times faster than Basic. Machine-code enthusiasts might care to consider what limitations the test places on the values of M and N.

Now for some arithmetic. Wherever a variable may be used in Basic an expression may be substituted, so some means has to be found to evaluate that expression. The method which has been chosen for ZXGT uses an often-mentioned but rarely-used mathematical function called recursion.

For those who have not come across recursion before, consider evaluation of n!, that is, n factorial; n! is defined as:

n! = n × (n-1) × (n-2) .... × 1

and we may rewrite this as:

n! = n × (n-1)!
 = n × (n-1) × (n-2) !

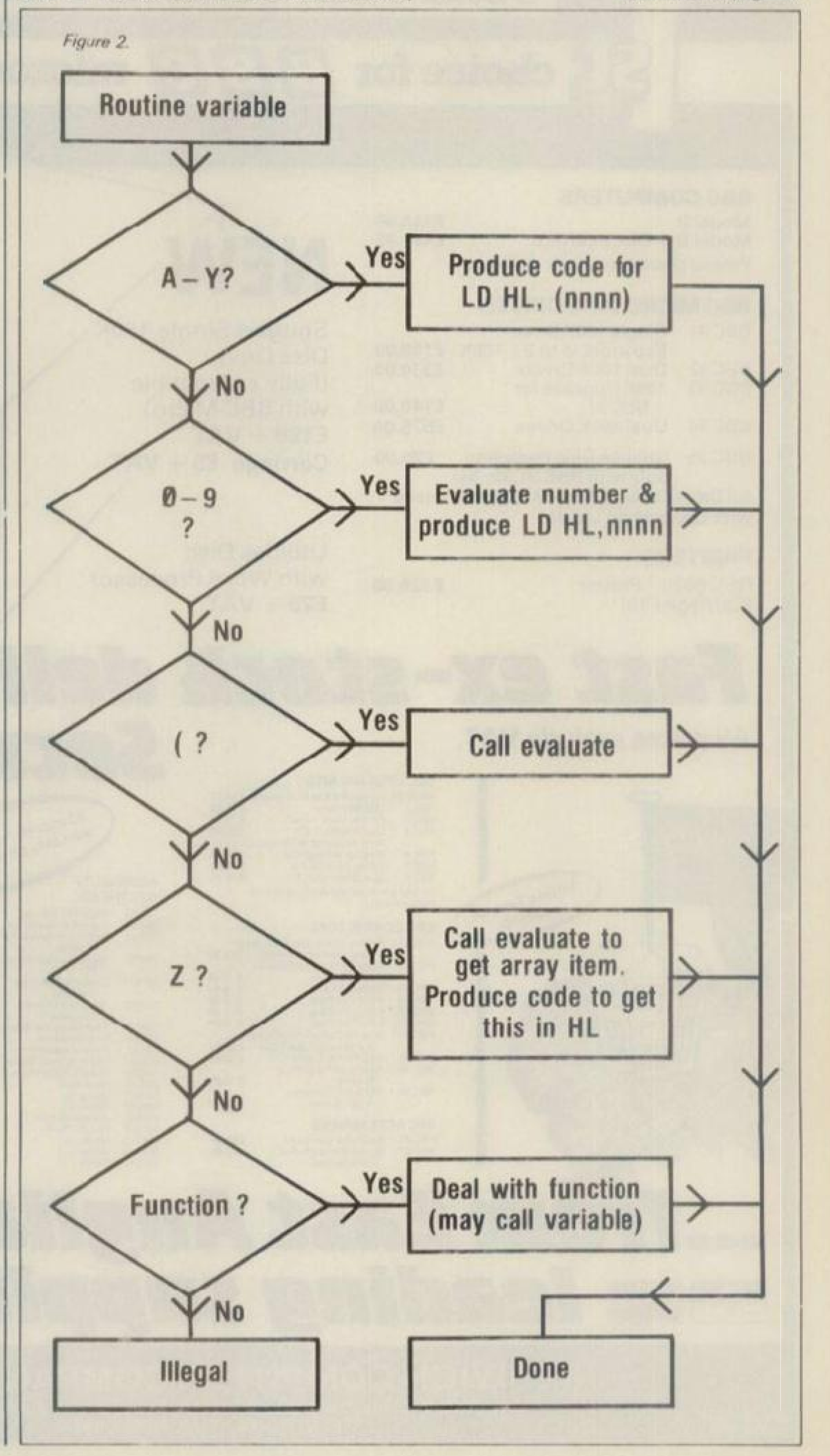
etc.

To calculate n! it is necessary to multiply n by (n-1)!. To calculate (n-1)! we multiply (n-1) by (n-2)! This process is continued until we arrive at 1! which is 1. Figure 1 shows a flow diagram for this process. The routine Factorial calls itself repeatedly.

The process of evaluating an expression uses a similar technique which is shown in figures 2 and 3. We see that Variable calls Evaluate and Evaluate calls Variable, but the way out may not be clear. Each time we enter Evaluate, a marker — 0 — is pushed on to the compiler stack and when we reach the end of the line or a right parenthesis, the stack is popped back to see what "pending operations" are left.

Operations are performed until an "operator" 0 is encountered. We placed this

(continued on page 81)



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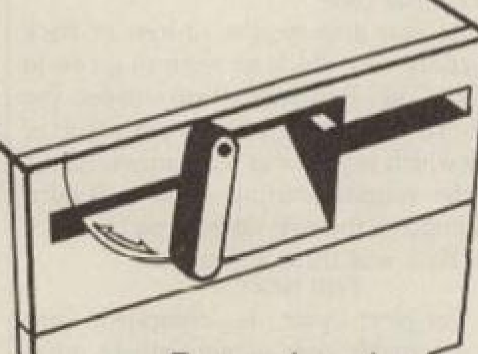
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(continued from page 79)

there to mark the end of the expression when we entered the routine. The exit is taken with the result in HL.

Two other points should be noted. Firstly, the right and left parentheses will match exactly, because of Sinclair's syntax checking. Secondly, we are using two different stacks. The operands of the expression are pushed on to the stack of the compiled program by code generated in the compiler. The operators are kept on the compiler stack and are used by the compiler to cause the correct code to be generated for combinations of operand in HL and DE.

In effect, infix notation is changed into postfix or reverse Polish.

The Let statement calls Evaluate directly. Many other Basic statements are supported such as: Fast-Slow, Input, Pause Rand/Rnd to seed and use the random number generator, Print, Scroll, Stop Unplot/Plot.

The ZX-81 does not have the ability to store on tape anything except Basic statements so where can the machine code generated by the compiler be put so that it may be recalled from tape for later use?

The general answer to this is "in a Rem statement" and that is the solution adopted by the compiler. The one twist is that the compiler generates its own Rem statement into which it puts the code. To accomplish this the code is first compiled over the ROM — and so not stored — and the resulting length of code is used in forming the Rem. It does not delete any old compiled code.

One of the best features of ZXGT is that the Basic may be run and tested under the interpreter before the compiler is invoked. One writes a program bearing in mind that eventually it will be compiled. When you are satisfied with your code a single Usr command runs the compiler and puts your code into the Rem statement. This is clearly a very powerful feature and one which should eventually become standard on all small machines.

Some people may not be aware of the way to make the large Rem required for ZXGT. A possible procedure is as follows: first, type a line 1:

1 REM ABCDEFGHIJKLMNOPQRSTUVWXY
ABCDEFGHIJKLMNOPQRSTUVWXY
ABCDEFGHIJKLMNOPQRSTUVWXY
ABCDEFGHIJKLMNOPQRS

This makes the total length of the line including the terminator — 118 — exactly 100 bytes. Check that

PEEK 16511

is 96. Second, edit line 1 changing the line number to 2. Third, edit line 2 to make it line 3. Repeat up to line 23. Fourth, edit line 1 adding 1234567 immediately after Rem. We now have the correct number of characters. Fifth, check that

PEEK 18815

is 118. Steps 6 to 10 of the procedure are:

POKE 16512,8
POKE '6511,255

(continued on page 83)

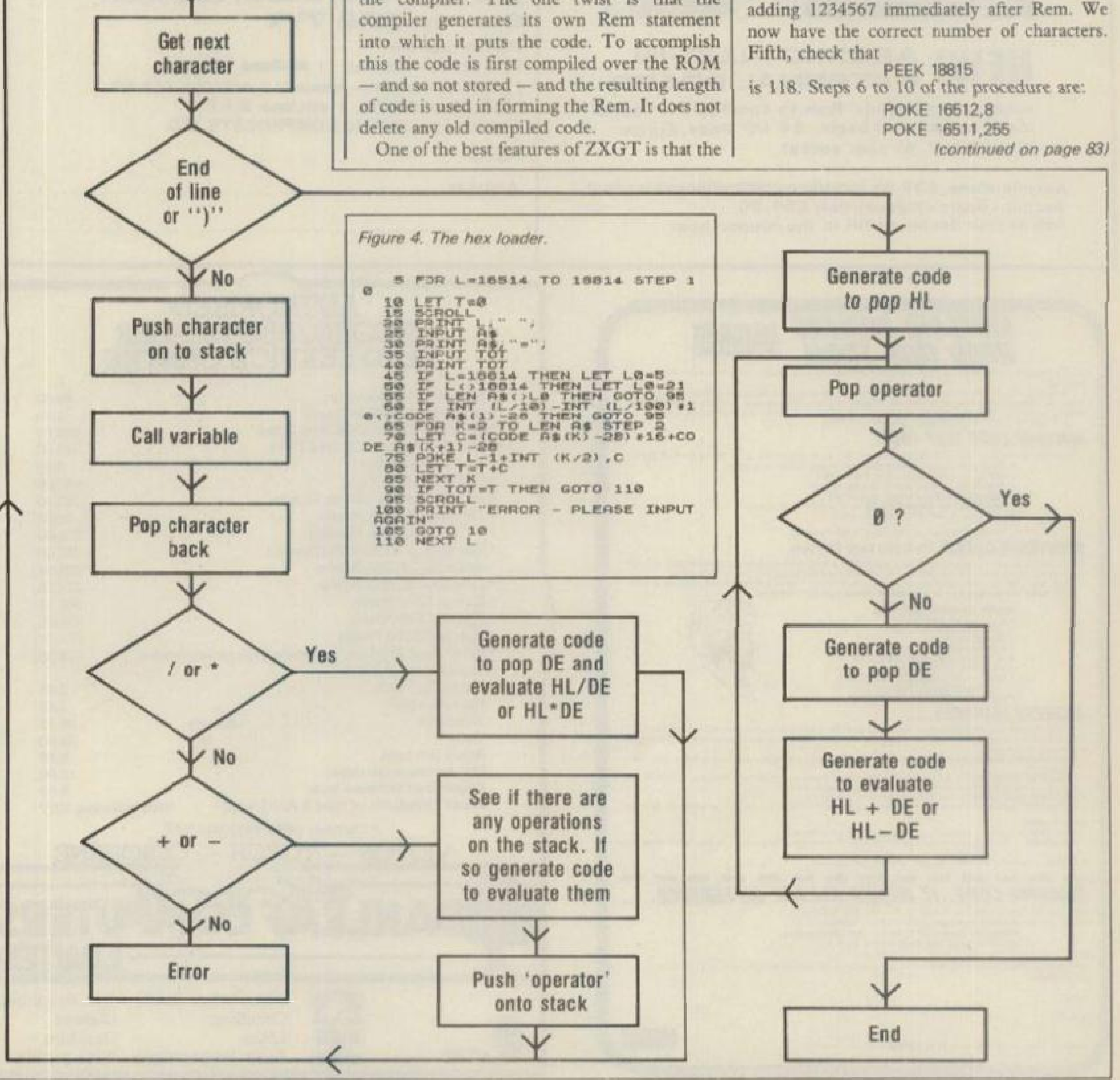


Figure 3.

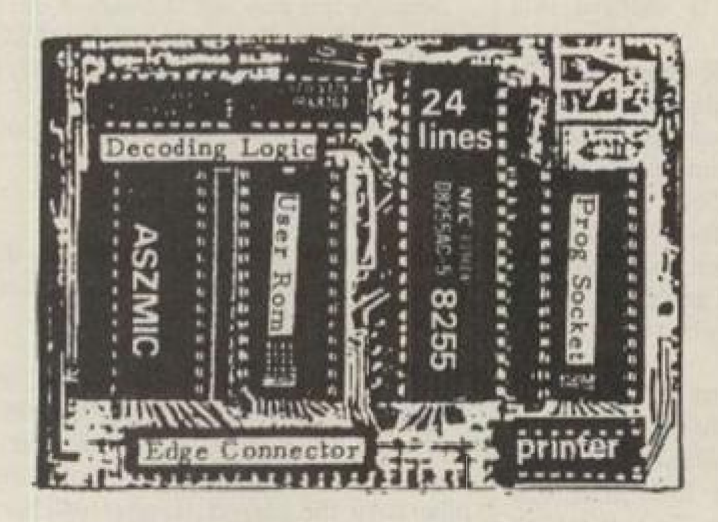
Figure 4. The hex loader.

```
   5 FOR L=16514 TO 18814 STEP 1
0
  10 LET T=0
  15 SCROLL
  20 PRINT L;" ";
  25 INPUT A$
  30 PRINT A$,"=";
  35 INPUT TOT
  40 PRINT TOT
  45 IF L=18814 THEN LET L0=5
  50 IF L<>18814 THEN LET L0=21
  55 IF LEN A$<>L0 THEN GOTO 95
  60 IF INT (L/10)-INT (L/100)*1
0<>CODE A$(1)-28 THEN GOTO 95
  65 FOR K=2 TO LEN A$ STEP 2
  70 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
  75 POKE L-1+INT (K/2),C
  80 LET T=T+C
  85 NEXT K
  90 IF TOT=T THEN GOTO 110
  95 SCROLL
 100 PRINT "ERROR - PLEASE INPUT
AGAIN"
 105 GOTO 10
 110 NEXT L
```

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(continued from page 81)

POKE 16514,118
POKE 16515,118
POKE 16510,0

You now have a Rem called line zero of length 2,303 bytes as required. Note that there are minor differences between the assembler code and the version of ZXGT in the hex dump.

Figure 4 shows the hex loader that will enable you to enter ZXGT. Note that the Rem to contain the code must be exactly 2,303 bytes in length, that is the total line length as defined by Sinclair. The loader will prompt with the address to be loaded and you should refer to figure 5 to see the hex string that should be entered.

You should input the 21 characters up to, but not including, the equals sign followed by Newline. You will then be prompted for the check number by an equals sign. If the hex and decimal agree you will be prompted for the next line of input. If they disagree you will be asked to re-enter the data. The last hex string only contains five characters.

The entry point to the complete compiler is 17389 — use Rand Usr 17389 or Let L=Usr 17389 — for the code to be put in a Rem at line 2 or 17381 if you wish it to ask where the code is to be put.

The entry to the code generated by ZXGT is at 18823. Use

Let L = USR 18823

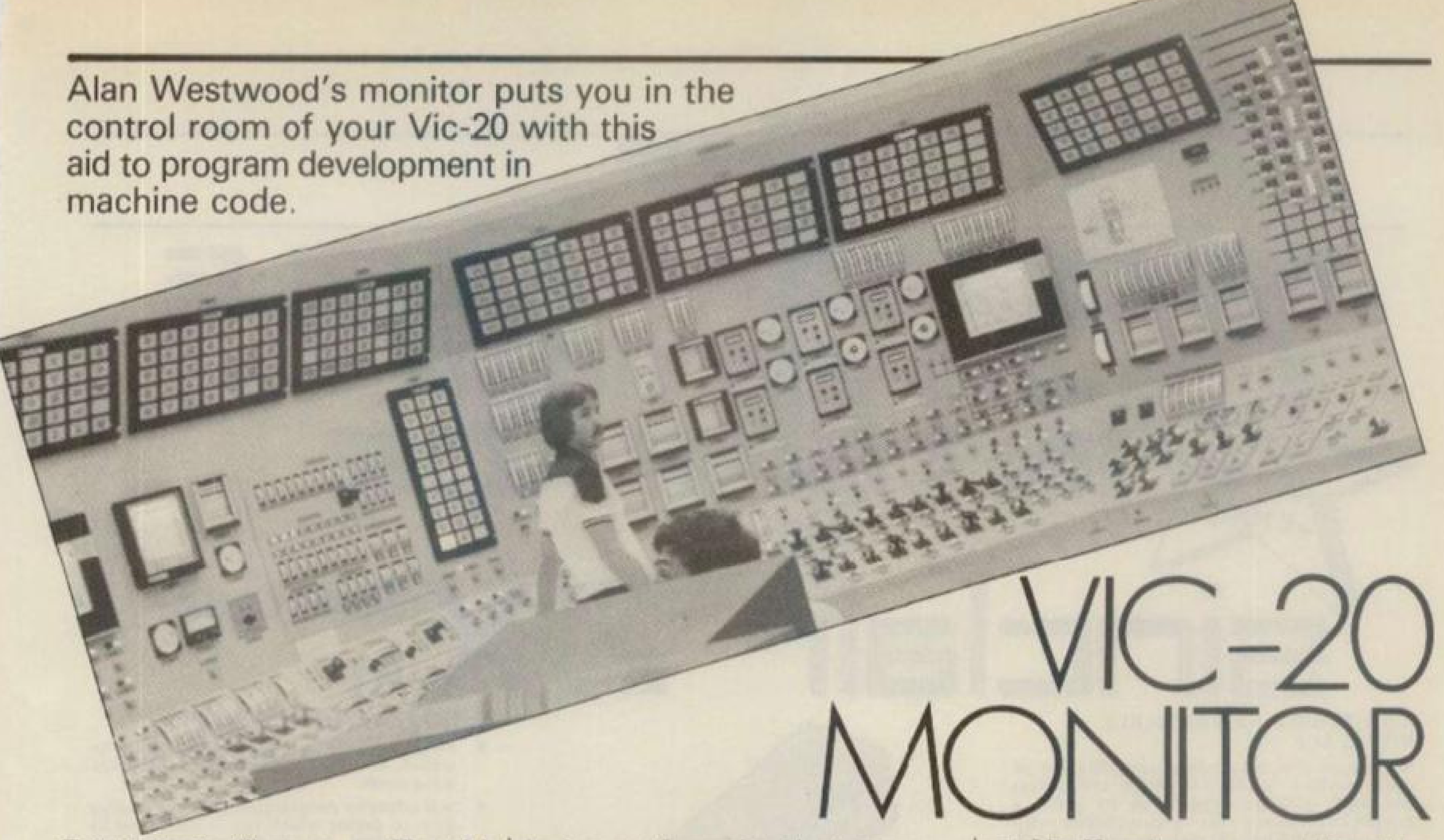
Do not use

RAND USR 18823

In future issues, we shall give the remaining third of the ZXGT assembler code and discuss how to avoid some of the restrictions mentioned in part 1. If you find the listing too daunting to type in the compiler is available on cassette for £8.95 from Personal Software Services, 452 Stoney Stanton Road, Coventry.

Figure 5. Hex dump of ZXGT compiler.

```
16514 1BFBDACB97676C3B440C3=1607
16524 22341C35741C34F41C385=1114
16534 341C39741C3AB41C32142=1201
16544 4C39C42C3DE42C33943C3=1414
16554 57A43C35743C3B843CF8C=1331
16564 6E5D5AFCD2142CB7C2808=1296
16574 73E16CD2142CD1B411110=718
16584 827CD0741301A11E803CD=847
16594 9074130151164 00CD0741=535
16604 030131E0ACD07413012C3=645
16614 1FC40CD0D4111E803CD0D=1069
16624 241116400CD0D411E0ACD=710
16634 30D411E01CD0D41AFD1E1=1001
16644 4C32142E5A7ED52E1C93E=1497
16654 51CA7ED5238033C18F919=931
16664 6C321427C2F677D2F6F23=886
16674 7C92A0C40112100E50100=599
16684 8000923E519EB21D602ED=1019
16694 942E3C1EBEDB0E101B602=1544
16704 009220E403E213239403E=449
16714 103323A40C9CDB8027CFE=1148
16724 2FE200ECD8B022420FACD=1217
16734 3B8027DFEFF28F8017FFD=1492
16744 4AFE5ED42E1CAB24001EF=1616
16754 5FCAFE5ED42E128DD4424=1549
16764 6C84DCDBD077EFE00C9CB=1462
16774 7FC2234402A34407CE67F=1041
16784 8B5C8CD4F4128F306104A=1109
16794 97BEB210000CB391F3001=731
16804 019EB29EB10F5C93E2890=1247
16814 1DADC42473E01CB283002=931
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16834 3EB417ECB07FE103007CB=1164
16844 40F3002EE8F47119E0C3A=762
16854 5304093FAE141F12FA018=1271
16864 602F1B0FE083802EE8F18=1144
16874 7363E1790DADC4279E61F=1169
16884 84FC5C5C5AFCB10CB10CB=1486
16894 91068672929C1484709C1=843
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16924 291323940C9D5E5C5F53A=1459
16934 33A40FE02283AF1FE7628=1129
16944 42AFE4030722A0E407723=796
16954 5220E403A39403D323940=523
16964 67EFE76204A3A3A403D32=895
16974 73A4023220E403E213239=471
16984 84018302A0E407EFE7628=802
16994 9E62318F82A0C4001F802=906
17004 009368FCD4F4128FBFE28=1140
17014 12815FE3F281BFE292008=780
17024 22110272B7DB420FBCD23=959
17034 3411803CD2A0AF1189AC1=961
17044 4E1D1C9CD690618D37881=1485
17054 5C81ACD2142130B18F5FE=1083
17064 6433809FEC0CBB7DA3542=1301
17074 7E53F2111014704FE2130=754
17084 804AFCD2142CB7E2320FB=1130
17094 910F97ECB7F2006CD2142=1063
17104 02318F5E63FCD2142AFC3=1271
17114 12D42CF8A7B8228FACD29=1293
17124 243C57CB20738F14B4211=1028
17134 30000D5EB2329EB297995=1070
17144 4789CEB30F6EBEBAF7C1F=1605
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17164 61CCB1D7995789CFAFE42=1376
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17194 97C17DC1B41EB7CA847CB=1260
17204 07CC21B41C9ED5B324063=1152
17214 12EFD7AB70600ED5298ED=1318
17224 252985F50ED5230012322=846
17234 33240CBBCC9030303C503=915
17244 4030303218049CDA30923=655
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17274 7210000E5E5CD5741FE16=1124
17284 82009E1D1F5E5CD214218=1277
17294 9F0FE76E1201F29E52929=1260
17304 0D1194FCD214279D61C38=1036
17314 1084F060009FE0A38D3F1=874
17324 23EE6CD214218C7F1CC1B=1291
17334 341C9C5E52A7B40F577E5=1514
17344 423227B40CD4F41FE2920=932
17354 5123E76CD2142E1CDB440=1176
17364 6F126006FCDB4401802E1=1090
17374 7F1E1C1AFC9C9C93E0FD7=1729
17384 8CD75491812210000CD12=693
17394 944CDF74803CD7849E5CD=1427
17404 00649E1CD1244CD5949CD=1167
17414 12044CD0D44CF7F3EC9C3=1178
17424 27B49227040ED5B1C4013=845
17434 3217240CD09452A704036=766
17444 418233668232279401168=592
17454 50019227B40217D40CDD4=885
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17484 848FEFACCC848FEDE28EA=1802
17494 9FEE9CC1D49FEECCC2B45=1599
17504 0FEEDCC4045FEEBCCC747=1791
17514 1FEF3CCF447FEE4CC0049=1775
17524 2FEF4CCB647FEE5CCF148=1955
17534 3FEEECC5D48FEF6CC6C48=1745
17544 4FEFCCC9248FEF1CC0346=1700
17554 5FEFBCC9F47FEE3CA9647=1843
17564 6FEF5CC5545FEEA2815FE=1660
17574 7E7CCA447FEFECC0D44FE=1717
17584 800200ECD4445FE762007=799
17594 9E1CD0E49C236443EB8CD=1284
17604 06849CD5949CF9BCD4D47=1259
17614 1215F49C3A947E556235E=1080
17624 2D5EBE5222340220A40CD=1123
17634 3EC45CD5349E1CD13451B=1211
17644 41BEBD1CD0945ED5B7B40=1269
17654 5CD0945E5ED5B7240A7ED=1422
17664 652E13803227240E1C973=1119
17674 7237223C95E235623C9E5=1065
17684 8C12A1C4023CD0E45EBA7=1052
17694 9ED42D02A7240ED52D8EB=1501
17704 02318ED3EC3F5CD4445CD=1345
17714 12A48CD1345EBCD0E45EB=1165
17724 2F1C3AB473ECD18E9E5E7=1662
17734 3FE762809FE7E2805F5CD=1296
17744 46849F1E1C9CD4445FE76=1558
17754 52877FE0B2813FEC1284C=1046
17764 6FED62874CD5047215349=1169
17774 7CDA947104F3E10CD7B49=1035
17784 82A7B40E5CD7B4901FFFF=1370
17794 92A164023037EF5CD6849=919
17804 0F1FE0B2805CD7B4918EF=1215
17814 1221640E1C571233E11CD=974
17824 2AB473E01E1CDAB47216B=1117
17834 349CDA9471812CD3747CD=1096
17844 4C14721434DCDAE4721F5=1169
17854 508CDA947CD4445FE1A28=1115
17864 68CFE19288821EC45CDA9=1307
17874 7472A16402B221640AFC9=738
17884 8CD4D473E7DCD7B492168=1078
17894 949CDA94718D63E76C368=1235
17904 049FE40D2C144D6261717=1160
17914 1ED4B794026006F09C9CD=1061
17924 24445CDF145FE64200ACD=1253
17934 32A493EE5CD7B4926FFE5=1329
17944 4CD4445FE14C2C144CD3D=1337
17954 546CDD345E17CFEFF200C=1457
17964 621D1EBCDAE47210945C3=1233
17974 7A9473E22C3AB47AFF5CD=1398
17984 84D473EE5CD7B49CD4445=1182
17994 9FE112850FE76284CF5CD=1329
18004 04D47F1FE152804FE1620=1016
18014 123C16778FE002004F5E5=1215
18024 218D8E521444DCDAE47CD=1302
18034 37E463EE5216960CDAB47=1168
18044 418C4F5C5181CFE182810=1048
18054 5FE17C2C144CDC6462162=1336
18064 649CDA94718ACCDC64621=1220
18074 76E4918F33EE1CD7B49F1=1379
18084 8FE00C8FE152811CDC646=1259
18094 921A7EBCDAE4721ED52CD=1442
18104 0AE4718E7CDC5463E19CD=1265
18114 17B4918DD3ED1C37B49FE=1357
18124 2D3200FCD4D47217E6FCD=1086
18134 3AE47212600C3AE47FED4=1222
18144 42012CD4D4721EB46C3A9=1105
18154 54701F146C5E5C96069C9=1412
18164 6FEC4C20F47CD4445FE41=1391
18174 7C2C144215C49CDA9473E=1160
18184 82621006FC3AB47FE40C2=1131
18194 91A47217249C3A947FED2=1216
18204 02011CD4D4721CB7CCDAE=1141
18214 1473EC4217A47C3AB47FE=1246
18224 2CFC2C144C34D47CD4D47=1358
18234 3CD4445F53EE5CD7B49CD=1484
18244 44D473ED1CD7B49F1C9CD=1467
18254 54445FE16F5CC4445FE10=1269
18264 62816FE40300DFE26D482=1075
18274 747DC8F47F1C27547C9CD=1544
18284 8CB4618F6CD3D4618F121=1177
18294 97A47182F7C2F677D2F6F=821
18304 023C9CDF145FE64CA3F49=1443
18314 13E2AC3AB47CD2A483E21=955
18324 21815CD0D44E1ED487B40=1055
18334 3C9212A0A180521564918=531
18344 4003ECDCD7B497DCD7B49=1194
18354 57CC37B49CD3747CDC147=1315
18364 621EB7318EDFE1AC2C144=1379
18374 7C9CD4445CDF145E5E5CD=1721
18384 84445CD37473E23CD7B49=966
18394 921ED53CDAE47E1CDAE47=1478
18404 03E222323CDA847E1ED5B=1166
18414 17B40CD0945C9CD4445CD=1218
18424 2F145E5E53E2ACDAB4721=1352
18434 32322CDAE47E1CDAE4723=1229
18444 4233EEDCD7B493E5BCDAB=1264
18454 5473EA721ED52CDAB473E=1161
18464 6FAE1CD0E45EBCDAB47C9=1646
18474 7210000180FCD4445FE7E=794
18484 8281AF5110A00CD6249F1=955
18494 9FE26D2C144FE1CDAC144=1524
18504 0D61C06004F0918DFE52A=854
18514 1164011050019221640E1=478
18524 2C9217549CDA947CD4445=1211
18534 3CDF145C338453E9BF5CD=1503
18544 43747CDC147214B45CDAE=1151
18554 5473E3ECD7B49F1CD7B49=1238
18564 63E32213040CDAB472165=838
18574 749C3A9473EA018D83E2A=1074
18584 8213440CDAB473E222132=775
18594 940C3AA47FEDD2812FE14=1307
18604 028141F3001E817A7ED52=884
18614 137F817D01808ED5237C0=1132
18624 21804ED5237C83FC9CD37=1126
18634 347672E3ECDAE4721A648=1003
18644 4CDA9472A0A4023CD1345=889
18654 5EBCD0E45EB3ED2CDAB47=1477
18664 6CD4445FEDEC2C144C921=1507
18674 7F748C3A947CDE702213B=1284
18684 840CBB6C9210649C3A947=1197
18694 9213B40CBF6C307024E23=922
18704 04609233A0C409DC03A0D=668
18714 1409CC9CD4445FE3FC2C1=1467
18724 244CD4D47AFC9CD4D4721=1183
18734 3ED4BCDAE47211C40CDAE=1266
18744 447212909C3AE47CD2A49=914
18754 53ED5CD7B49210E45CDA9=1166
18764 64721EBD1C3AE47C38840=1383
18774 7C38B40C38E40C39140C3=1398
18784 89440C39740C39A40C39D=1387
18794 940C3A040EBC3A340C3A6=1501
18804 040C3A940C3AC40C3AF40=1357
18814 1AF40=239
```



Alan Westwood's monitor puts you in the control room of your Vic-20 with this aid to program development in machine code.

VIC-20 MONITOR

THIS MONITOR will run on any Vic and is designed to aid the development of machine-code programs. Listing 1 shows a loading program which Pokes the monitor into memory. Unfortunately, it will not run on an unexpanded machine — though the monitor will — and so those of you with only the basic machine will have to use listing 2.

When run, the monitor reassembles itself above RAMtop, taking up about 980 bytes. The monitor is therefore transparent to Basic and will happily sit above RAMtop while leaving space for running other programs.

If you have an expanded machine, simply enter listing 1 then Save and Verify before running. This is your back-up copy. When you run the loader any errors will be detected by the checksum — it checks for zeros too — and the Data line number in which the error was found will be printed. Once all is correct, Run the loader and then Poke the addreesses indicated with the values printed at the end of the program.

Then save the monitor — whatever you, do not List. If you have an unexpanded machine do the following:

POKE 45,3: POKE 47,3: POKE 49,3: POKE 46,21: POKE 48,21: POKE 50,21: POKE 43,1: POKE 44,21: POKE 5376,0

then enter listing 2. Run the program and enter the code as in listing 1, starting at Data line number 210. The first data string on each line is the code, the second is the checksum. If you enter it incorrectly the program will print

C/SUM ERROR

and will ask for the data again. When you have finised enter an asterisk and the program will stop. Now do the following:

POKE 45,244: POKE 47,244: POKE 49,244: POKE 46,20: POKE 48,20: POKE 50,20: POKE 43,1: POKE 44,16

then Save and Verify as a normal program — do not list.

One you have a copy or two on tape, switch the machine off then on to clear the memory, reload, and, before running, Clear screen. You should now be in the monitor proper.

The first function the monitor performs is to set the breakpoint vector to point at the start of the monitor. What this means is that, when testing machine-code routines, breakpoints can be set by simply inserting BRK instructions 00 in appropriate places.

When this instruction is met, the program will automatically return control back to the monitor with the register values. The second function the monitor performs is to save the register values in the following addresses:

PC> = 00 PC< = 01 SR = 02 AR = 03 XR = 04 YR = 05 SP = 06

The program then sets up the display and hands command to the user.

Now for a description of the commands; see figure 1 for a summary. There is full syntax checking so commas and so on must be entered where indicated, addresses should be in hex and of the length shown. All the

(continued on page 87)

Listing 1.

```
5 REM VICMON A.WESTWOOD C.1983
10 PRINT"[]":AD=PEEK(56):A1=AD-6:POKE56,A1:POKE52,A1
20 A2=A1*256+PEEK(55):A3=A2
30 CT=0:A$=""
40 IFA$=""THENREADCS:IFCS<>CTTHENPRINT"[]C/SUM ERROR LINE"PEEK(64)*256+PEEK(63)
45 IFA$=""ANDCS<>CTTHENPOKE56,AD:POKE52,AD:POKE51,PEEK(55):STOP
50 IFA$=""THENCT=0:READA$:PRINTA$:IFA$="*"THEN80
60 H$=LEFT$(A$,2):GOSUB1000:CT=CT+D+1:POKEA2,D
70 A$=MID$(A$,3):A2=A2+1:GOTO40
80 POKE52,AD:POKE56,AD:POKE54,AD:POKE53,PEEK(55):POKE51,PEEK(55)
90 PRINT"POKE44:"INT(A3/256)
100 PRINT"POKE43:"A3-(INT(A3/256)*256)+1
110 PRINT"POKE45,47&49:"A2-(INT(A2/256)*256)
120 PRINT"POKE46,48&50:"INT(A2/256)
130 PRINT"THEN SAVE "VICMON"":END
200 DATA0
210 DATA0028040A008F22141414141414141408D931E5645434D4F4E0D119E412E574553,1070
220 DATA54574F4F442031393833004604140 09E20C228343329AA323536ACC228343429,2222
230 DATAAA30373129000000A52D8522A52E8523A5378524A5388525A000A522D002C623,2733
240 DATAC6228122D03CA522D002C623C6228122F021852 6A522D002C623C62201221065,3402
250 DATA24AAA52665254 0A537D002C630C6376091378A40A537D002C630C63760913718,3367
260 DATA90B6C90FD0EDA5370533A53805346C37000000BF78ADFEFF00AEFFFF000D1603,4011
270 DATA0E1703A9002090FF5000006805056805046805036805026805016805000 0BA06,2773
280 DATA0630A501E9028501A50000E9000085000020 79E5ADA3FF00ACA4FF00201ECB20,3021
290 DATAADFD00ADC7FF00ACC0FF00201ECB20F3FD0020A0FC002083FC0020CFFFC920F0,4387
300 DATAF9A209DDE0FF00D01285 1C8A0AAABDEAFF0085C1BDEBFF0085C26CC10000CA10,4386
310 DATAE6A93F20D2FF4C60FC00209FFF20E4FFC90000F0F6602001E5A20000200DEAA9,4295
320 DATA0D20D2FF4C01E5C93A00290F20900269006 0A900008 52A20CFFFC920F0F920E1,3511
330 DATAFC00901720CFFFC9309010 20C3FC00062A062A062A062A052A052A306020CFFF,2093
340 DATAC92CD00C20CEFC009007AA20CEFC009001606660 4CA0FC0020CFFFC90DF0F46020,4056
350 DATAF6FC0085C386C4A905051E200EFD00C92CD0E320CEFC0090DEA2000001C3C1C3,4234
360 DATAD0F1E6C3D002E6C4C61ED0E220F3FD0020A0FC00C949F0034C60FC004820B3FC,4668
370 DATA006820D2FFA92C20D2FFA5C3A6C420EAFD004C1DFD0020F6FC0085C186C220F6,4404
380 DATAFC0085C386C420F6FC000541 0642C5C10AE5C2900AA5C3C541A5C4E542B09DA5,4751
390 DATAC3C5C1A5C4E5C29014A20000A1C10141E6C1D002E6C2E641D002E642D0E220F3,4A42
400 DATAFD004C7AFC0018A00000A20120F0FFADACFF00ACADFF00201ECBA501A6000020,3438
410 DATAEAFD00A9000085C26902 85C14C32FE001069F69002690669 3A4CD2FF404A4A4A,3458
420 DATA4A20D0FD0068290F4CD0FD00488A20DCFD006 04CDCFD00A541A64285C186C2A2,3942
430 DATA0418861EA000020F0FFA9DD20D2FFA5C1A6C220EAFD002032FE00A5C1106905,3063
440 DATA85C19006A5C26900 0085C2E61E10A61EA000020F0FFE017D0D460A00000A9DD,3779
450 DATA20D2FFB1C120DCFD00C8C005D0F1A9DD4CD2FF20F6FC000541 064220F3FD004C,4713
460 DATA7AFC00A54110695A854190F1A5426900001 0AA90E7A54138E95A854180E0A542,3781
470 DATAE900001090ED20F6FC0085C186C220F6FC0085C386C4A2000020CFFFC92CF006,4109
480 DATAC90DF00CD03D20CEFC009563E8E003D0E9861EA61EA000001C1D9630000F017,3874
```

(listing continued on page 87)

AGF

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ABOUT OUR PROGRAMMABLE INTERFACE

Surpassing the outstanding specification of our Interface Module II which still offers the best software support at its price, a Joystick Interface that is compatible with ALL SOFTWARE through its unique hardware programmable design.

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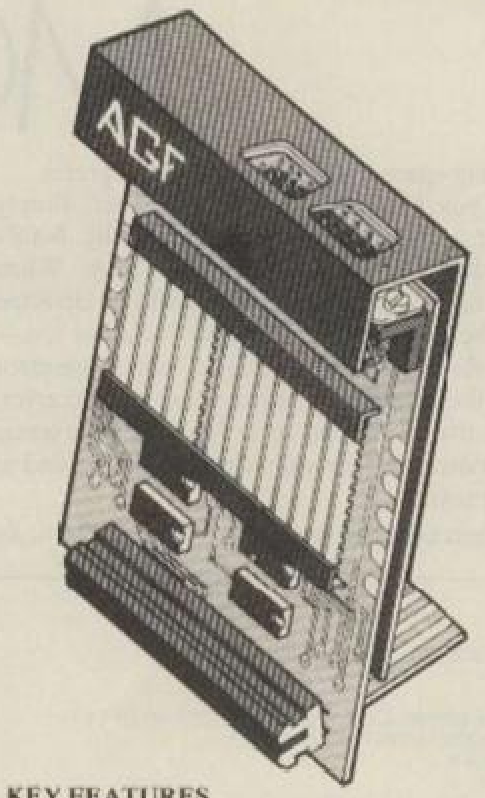
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The unique AGF key simulation principle makes it extremely easy to incorporate Joystick action in your own programs. All eight directions and fire are read by simple BASIC.

With every order comes a free demonstration program called 'Video Graffiti' plus a full set of instructions.



KEY FEATURES

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- One pack of ten Quick Reference Programming Cards for at-a-glance setting to your games requirements. The card allows you to mark the configuration in an easy to read fashion with space to record the software title and company name.
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ZX81 ☐	ZX SPECTRUM ☐ Please tick	FINAL TOTAL	

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(continued from page 85)

commands are entered in the top line of the screen. Here they are:

V,aaaa

This displays a screen page of memory from address aaaa by entering carriage-return on its own. The next screen page of memory is displayed, and, for continuity, the last line of the previous page becomes the first line of the next page. Entering P will display the previous page and the first line becomes last.

I,aaaa,11,22,33,44,55

This inputs up to five bytes of memory starting at address aaaa. If five bytes are entered, the monitor will wait for an input. If you now press I the next address for input will be displayed on the command line. This has been included for fast entry code.

H,aaaa,bbbb,11,22,33

Hunts between addresses aaaa and bbbb for a sequence of one, two or three bytes.

M,aaaa,bbbb,cccc

Moves a block of memory between addresses aaaa and bbbb to a block starting at address cccc. If you try to move the block upwards through memory into its own space then the monitor will reject it, thus preventing corruption of the block.

It will, however, accept movement down through memory as this will not corrupt the block, that is, it will accept

M,1000,2000,0fff

but will reject

M,1000,2000,1001

You can move memory freely in either direction, if you are moving the block outside its own space. Note the monitor is not protected from this function, so you must be careful when using this it.

G,aaaa

Goto code starting at address aaaa. If G is input on its own then control will be handed over to code staring at the address in the PC register. The registers can be changed before going to a routine by inputting the values into the register storage addresses, which are 0000-0006.

Q

Quit to Basic. Basic programs can be entered and run as normal provided they do not write over the monitor. To return to the monitor SYS60151.

L or L"prog name"

Loads memory into the address from which it was saved.

S"prog name",01,aaaa,bbbb

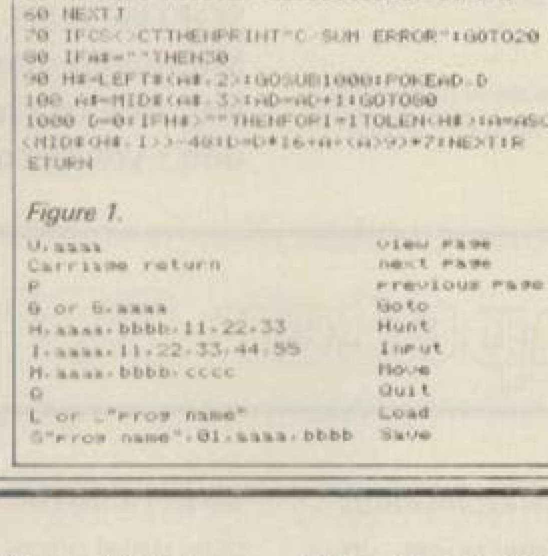
Saves memory between addresses aaaa and bbbb to cassette.

One last thing, if you exceed the command line and corrupt the display simply clear the screen and enter C, and this will return the display to normal.

If anybody would like a copy of this program on tape then they should send a cheque or postal order for £3 to this address Monitor, 57 Trentham Street, London, SW18 5DH. I will also include a copy of my disassembler on the tape. ■

Listing 1 continued from page 85.

```
490 DATAE6C1D002E6C2A5C3C5C1A5C4E5C2901320E1FFD0E0F00CC0CAD0DEA5C18541A5.5535
500 DATAC285424C60FC004CA0FC0020CFFFC900F00720F9FC00050196000020 79E5A606.3655
510 DATA9AA50000040A50140A50240A503A604A4054078A6069A6C02C02079E54C60FC00.3033
520 DATA2079E54CA0FC00A00184BA04990004B704900493A902058CA940858B20CFFFC9.4444
530 DATA20F0F9C900F01AC922D0D620CFFFC922F025C900F00B91B8E687C0C010F0C2D0.4956
540 DATAEAA51CC94CD0E22079E5A900020D5FFA5902910D0F0F0A420CFFFC90DF0E3C9.4815
550 DATA2CD0F120CEFC00290FF0D4C933F0FA05BA20F6FC0005C196C220F6FC0005AE06.4691
560 DATAAF20CFFFC920F0F9C900D0D8451CC953D0F0A90D20D2FFA90185B92079E52082.4705
570 DATAF64CFEFE00A5FF00425245414B0E0000AEFF00128 0C05043C0B23332B2415282.3653
580 DATA5052B25952B25350AE0DD0000C9FF000DABC0C0C0C0DBC0C0DBC0C0DBC0C0DB.4736
590 DATAC0C0DBC0C0B300005147 4D484956534C500DF7FE00D3FE0063FD0076FE0016FD.3875
600 DATA0048FE000AFF000AFF0066FE0055FE003AFC00.1800
610 DATA*
1000 D=0:IFH$>""THENFORI=1TOLEN(H$):A=ASC(MID$(H$,I))-48:D=D*16+A+(A>9)*7:NEXT:R
ETURN
```



Listing 2.

```
10 AD=4096:PRINT"[J"
20 A$=""
30 INPUT"CODE@";A$:IFA$="*"THENEND
35 INPUT"C/SUM";CS:CT=0
40 FORJ=1TOLEN(A$)-1STEP2
50 H$=MID$(A$,J,2):GOSUB1000:CT=CT+D+1
60 NEXTJ
70 IFCS<>CTTHENPRINT"C/SUM ERROR":GOTO20
80 IFA$=""THEN30
90 H$=LEFT$(A$,2):GOSUB1000:POKEAD,D
100 A$=MID$(A$,3):AD=AD+1:GOTO80
1000 D=0:IFH$>""THENFORI=1TOLEN(H$):A=ASC(MID$(H$,I))-48:D=D*16+A+(A>9)*7:NEXT:R
ETURN
```

Figure 1.

V,aaaa	View page
Carriage return	next page
P	Previous page
G or G,aaaa	Goto
H,aaaa,bbbb,11,22,33	Hunt
I,aaaa,11,22,33,44,55	Input
M,aaaa,bbbb,cccc	Move
Q	Quit
L or L"prog name"	Load
S"prog name",01,aaaa,bbbb	Save

Listing 1. The initialising program.

```
    5 REM FOR £ READ HASH CHARACTER
   10 REM        ... SCRAMBLER ...
   30 REM Copyright (c) D.Griffin 1983
   70 MODE 7
   80 VDU 23,1,0;0;0;0;
   90 PROCtitle
  100 PROC_machine_code
  110 CHAIN ""
  120 END
  130 DEFPROCtitle
  140 FOR I=0 TO 5:VDU 31,0,I,132,157,150,31,39,I,156:NE
XT
  150 PRINT TAB(3,0);"     _ppp0  _ppp0   pppp   _ppp"
  160 PRINT TAB(3,1);" h!,[j:v5(,[j:A5!,145!kh![jh"h,14"
  170 PRINT TAB(3,2);" ju'";755/z;_0554455!k;j";CHR$255
;"jh"j+e5 "
  180 PRINT TAB(3,3);" j7-jjt;55!;j;u55555up"j*ojpzjh45
"
  190 PRINT TAB(3,4);" */,/   ,-/,   ,---%  !,,,  !,,-%
"
  200 PRINT TAB(4,7);"Copyright (c) David Griffin 1983"
  210 FOR I=10 TO 23
  220 VDU 31,0,I,145
  230 NEXT
  240 A$="iahagahegaheiejekelekakelemanenamalalakajaiaha
gafafegagaheieiahaiahagafafege"
  250 FOR I=1 TO 76 STEP 2
  260 Y=ASC(MID$(A$,I,1))-97
  270 C=ASC(MID$(A$,I+1,1))-97
  280 FOR X=18 TO 23-Y STEP -1
  290 VDU 31,I/2+1,X,255
  300 NEXT
  310 VDU 31,I/2+1,23-Y,C+116
  320 NEXT
  330 FOR I=19 TO 23
  340 VDU 31,1,I,157,131,31,39,I,156
  350 NEXT
  360 VDU 31,8,21:PRINT "Easy or Hard Game ?"
  370 REPEAT A$=GET$
  380 UNTIL A$="E" OR A$="H"
  390 PRINT TAB(6,21);"Please wait approx. 1 minute"
  400 IF A$="E" PROC_terrain(1) ELSE PROC_terrain(0)
  410 PRINT TAB(6,21);SPC(30)
  420 VDU 28,8,22,35,19
  430 ENDPROC
  440
  450
  460 DEFPROC_machine_code
  470 FOR PASS=0 TO 2 STEP 2
  480 P%=&4000
  490 [OPT PASS
  500 .SCROLL
  510 LDY £2
  520 .NN
  530 LDA &7C78,Y:STA &7C77,Y
  540 LDA &7CA0,Y:STA &7C9F,Y
  550 LDA &7CC8,Y:STA &7CC7,Y
  560 LDA &7CF0,Y:STA &7CEF,Y
  570 LDA &7D18,Y:STA &7D17,Y
  580 LDA &7D40,Y:STA &7D3F,Y
  590 LDA &7D68,Y:STA &7D67,Y
  600 LDA &7D90,Y:STA &7D8F,Y
  610 LDA &7DB8,Y:STA &7DB7,Y
  620 LDA &7DE0,Y:STA &7DDF,Y
  630 LDA &7E08,Y:STA &7E07,Y
  640 LDA &7E30,Y:STA &7E2F,Y
  650 LDA &7E58,Y:STA &7E57,Y
  660 LDA &7E80,Y:STA &7E7F,Y
  670 LDA &7EA8,Y:STA &7EA7,Y
  680 LDA &7ED0,Y:STA &7ECF,Y
  690 LDA &7EF8,Y:STA &7EF7,Y
  700 LDA &7F20,Y:STA &7F1F,Y
  710 LDA &7F48,Y:STA &7F47,Y
  720 LDA &7F70,Y:STA &7F6F,Y:LDA &7F98,Y:STA &7F97,Y
  730 INY:CPY £40:BEQ MM:JMP NN
  740 .MM LDY £0:LDX £20:LDA £&9F:STA &70:LDA £&7C:STA &
71
  750 .NN1 LDA £32:STA (&70),Y
  760 CLC:LDA &70:ADC £40:STA &70:LDA £0:ADC &71:STA &71
  770 DEX:BPL NN1
  780 RTS
  790 .PRI
  800 LDY £0:LDX &80
  810 LDA £&BF:STA &70:LDA £&7F:STA &71
  820 .NN2 CPX £0:BEQ NN0 LDA £255:STA (&70),Y
  830 CLC:LDA &70:SBC £39:STA &70:LDA &71:SBC £0:STA &71
  840 DEX:JMP NN2
  850 .NN0 LDA &79:STA (&70),Y
  860 LDY £0:LDX &82
  870 LDA £&9F:STA &70:LDA £&7C:STA &71
  880 .NN3 CPX £0:BEQ NN9 LDA £255:STA (&70),Y
  890 CLC:LDA &70:ADC £40:STA &70:LDA &71:ADC £0:STA &71
  900 DEX:JMP NN3
  910 .NN9 LDA &7A:STA (&70),Y
  920 RTS
  930 .RUB
  940 LDY £0
  950 LDA £32:STA (&50),Y
  960 INY:STA (&50),Y
  970 INY:STA (&50),Y
  980 INY:STA (&50),Y
  990 LDY £40:STA (&50),Y
 1000 INY:STA (&50),Y:INY:STA (&50),Y:INY:STA (&50),Y:IN
Y:STA (&50),Y
 1010 LDY £80:STA (&50),Y
 1020 INY:STA (&50),Y:INY:STA (&50),Y:INY:STA (&50),Y
 1030 RTS
 1040 .MAN
 1050 LDY £0
 1060 LDA £&3C:STA (&50),Y
 1070 INY:LDA £&60:STA (&50),Y
 1080 INY:LDA £&2C:STA (&50),Y
 1090 INY:LDA £&30:STA (&50),Y
 1100 LDY £40
 1110 LDA £&78:STA (&50),Y
 1120 INY:LDA £&FF:STA (&50),Y
 1130 INY:STA (&50),Y
 1140 INY:STA (&50),Y
 1150 INY:LDA £44:STA (&50),Y
 1160 LDY £80
 1170 LDA £&20:STA (&50),Y
 1180 INY:LDA £&22:STA (&50),Y
 1190 INY:LDA £&2C:STA (&50),Y
 1200 INY:LDA £&21:STA (&50),Y
 1210 RTS
 1220 .CHECK
 1230 LDY £0
 1240 LDA (&50),Y:CMP £32:BNE HITT
 1250 INY:LDA (&50),Y:CMP £32:BNE HITT
 1260 INY:LDA (&50),Y:CMP £32:BNE HITT
 1270 INY:LDA (&50),Y:CMP £32:BNE HITT
 1280 LDY £40
 1290 LDA (&50),Y:CMP £32:BNE HITT
 1300 INY:LDA (&50),Y:CMP £32:BNE HITT
 1310 INY:LDA (&50),Y:CMP £32:BNE HITT
 1320 INY:LDA (&50),Y:CMP £32:BNE HITT
 1330 INY:LDA (&50),Y:CMP £32:BNE HITT
 1340 LDY £80
 1350 LDA (&50),Y:CMP £32:BNE HITT
 1360 INY:LDA (&50),Y:CMP £32:BNE HITT
 1370 INY:LDA (&50),Y:CMP £32:BNE HITT
 1380 INY:LDA (&50),Y:CMP £32:BNE HITT
 1390 RTS
 1400 .HITT LDA £1:STA &75:RTS
 1410 .FIRE
 1420 LDY £0
 1430 LDA (&72),Y:CMP £32:BNE FIREEND
 1440 INY:LDA (&72),Y:CMP £32:BNE FIREEND
 1450 INY:LDA (&72),Y:CMP £32:BNE FIREEND
 1460 LDA £44:STA (&72),Y
 1470 CLC:LDA &72:ADC £2:STA &72:LDA £0:ADC &73:STA &73
 1480 RTS
 1490 .FIREEND STA &54:LDA £0:STA &74:RTS
 1500 .BOMB
 1510 LDY £0
 1520 CLC:LDA &76:ADC £41:STA &76:LDA £0:ADC &77:STA &77
 1530 LDA (&76),Y:CMP £32:BNE BOMBEND
 1540 LDA £43:STA (&76),Y:RTS
 1550 .BOMBEND
 1560 LDA £0:STA &78:RTS
 1570 .ROCKET
 1580 LDY £0
 1590 LDA £96:STA (&55),Y
 1600 INY:LDA £117:STA (&55),Y
 1610 INY:LDA £32:STA (&55),Y
 1620 LDY £40:LDA £104:STA (&55),Y
 1630 INY:LDA £122:STA (&55),Y
 1640 INY:LDA £32:STA (&55),Y
 1650 LDY £80:LDA £104:STA (&55),Y
 1660 INY:LDA £109:STA (&55),Y
 1670 INY:LDA £32:STA (&55),Y
 1680 RTS
 1690 .RUBOUT
 1700 CLC
 1710 LDY £0:LDX &57
 1720 .RUB1
 1730 LDA £32
 1740 STA (&58),Y
 1750 INY:STA (&58),Y
 1760 INY:STA (&58),Y
 1770 TYA:ADC £38:TAY
 1780 DEX:BPL RUB1
 1790 RTS
 1800 .MROCKETS
 1810 LDY £0:LDX £0
 1820 .ROCKET1 LDA &90,X:CMP £0:BEQ NROC
 1830 CLC:LDA &92,X:SBC £0:STA &92,X
 1840 LDA &93,X:SBC £0:STA &93,X
 1850 LDY £0:LDA (&92,X),Y:CMP £32:BNE ROCKET2
 1860 LDA £0:STA &90,X:JMP NROC
 1870 .ROCKET2
 1880 LDA &91,X:CMP £0:BEQ ROCKET3
 1890 DEC &91,X:JMP NROC
 1900 .ROCKET3 LDA £2:STA &57:LDA &92,X:STA &58:LDA &93,
X:STA &59:STX &5A:JSR RUBOUT:LDX &5A
 1910 CLC:LDA &92,X:SBC £39:STA &92,X:LDA &93,X:SBC £0:S
TA &93,X
 1920 LDY £0:LDA (&92,X),Y:CMP £32:BEQ ROCKET4:LDA £0:ST
A &90,X:JMP NROC
 1930 .ROCKET4 LDY £255:LDA (&92,X),Y:CMP £32:BEQ ROCKET
5:LDA £0:STA &90,X:JMP NROC
 1940 .ROCKET5 LDA &92,X:STA &55:LDA &93,X:STA &56:STX &
5A:JSR ROCKET:LDX &5A
 1950 .NROC INX:INX:INX:INX:CPX £27:BPL ROCKET6:JMP ROCK
ET1
 1960 .ROCKET6 RTS
 1970 .BOUNCER
 1980 LDY £0
 1990 LDA £104:STA (&5B),Y
 2000 INY:LDA £111:STA (&5B),Y
 2010 INY:LDA £109:STA (&5B),Y
 2020 LDY £40:LDA £34:STA (&5B),Y
 2030 INY:LDA £47:STA (&5B),Y
 2040 INY:LDA £39:STA (&5B),Y
 2050 RTS
 2060 .MBOUNCE
 2070 LDX £0:LDY £0
 2080 .NNB LDA &84,X:CMP £0:BNE BOO:JMP BON
 2090 .BOO CLC:LDA &83,X:SBC £0:STA &83,X:LDA &84,X:SBC
£0:STA &84,X
 2100 LDA (&83,X),Y:CMP £32:BNE BO1
 2110 LDA £0:STA &84,X:JMP BON
 2120 .BO1 LDA &83,X:STA &58:LDA &84,X:STA &59:LDA £1:ST
A &57:STX &5A:JSR RUBOUT:LDX &5A:LDY £0
 2130 CLC:LDA &83,X:SBC £0:STA &5D:LDA &84,X:SBC £0:STA
&5F
 2140 LDA (&5D),Y:CMP £128:BMI BO2:CMP £255:BEQ BO2:LDA
£0:STA &84,X:JMP BON
 2150 .BO2 LDA &85,X:CMP £1:BNE BO3:CLC:LDA &83,X:SBC £3
9:STA &83,X:LDA &84,X:SBC £0:STA &84,X:JMP BO4
 2160 .BO3 CLC:LDA &83,X:ADC £40:STA &83,X:LDA &84,X:ADC
 £0:STA &84,X
 2170 .BO4 CLC:LDA &83,X:SBC £78:STA &5D:LDA &84,X:SBC £
0:STA &5E:LDA (&5D),Y:CMP £32:BNE BO5:CLC:LDA &83,X:ADC
£121:STA &5D:LDA &84,X:ADC £0:STA &5E:LDA (&5D),Y:CMP £3
2:BEQ BO6
 2180 .BO5 LDA &85,X:CMP £1:BEQ BOT:LDA £1:STA &85,X:JMP
 BO6
 2190 .BOT LDA £0:STA &85,X
 2200 .BO6 LDA &83,X:STA &5B:LDA &84,X:STA &5C:JSR BOUNC
ER
 2210 .BON INX:INX:INX:CPX £9:BPL BEND:JMP NNB
 2220 .BEND RTS
 2230 RTS
 2240 ]:NEXT
 2250 ENDPROC
 2260
 2270
 2280 DEFPROC_terrain(SS%)
 2290 Y1%=0:Y2%=0:AX%=0
 2300 FOR X%=&5000 TO &501E STEP 3
 2310 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 2320 Y1%=Y1%+1
 2330 NEXT
 2340 FOR X%=&5021 TO &55DF STEP 3
 2350 AX%=AX%+1
 2360 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 2370 NN%=RND(3)-2
 2380 Y1%=Y1%+NN%
 2390 IF Y1%<2 OR Y1%>12 Y1%=Y1%-NN%:GOTO 2370
 2400 IF AX%<3 OR ?X%<?(X%-3) OR ?X%<?(X%-6) GOTO 2440
 2410 IF RND(7+SS%*7)=1 ?(X%+2)=5:AX%=0:GOTO 2440
 2420 IF RND(4-SS%*2)>1 GOTO 2440
 2430 ?(X%+2)=RND(3):AX%=0
 2440 NEXT
 2450 FOR X%=&55E2 TO &55FD STEP 3
 2460 Y1%=Y1%-1:IF Y1%<0 Y1%=0
 2470 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 2480 NEXT
 2490 AX%=0
 2500 Y2%=0:Y1%=0
 2510 FOR X%=&5600 TO &5BEB STEP 3
 2520 AX%=AX%+1
 2530 ?X%=Y1%:?(X%+1)=Y2%:?(X%+2)=0
 2540 Y1%=Y1%+RND(3)-2:Y2%=Y2%+RND(3)-2
 2550 IF Y1%<1 Y1%=1
 2560 IF Y2%<0 Y2%=0
 2570 IF Y1%+Y2%<9 GOTO 2600
 2580 IF Y1%>0 Y1%=Y1%-1
 2590 IF Y2%>0 Y2%=Y2%-1
 2600 IF AX%>=12 AND RND(7+SS%*7)=1 ?(X%+2)=4:AX%=0
 2610 NEXT
 2620 FOR X%=&5BEE TO &5BFD STEP 3
 2630 Y1%=Y1%-1:Y2%=Y2%-1
 2640 IF Y1%<0 Y1%=0
 2650 IF Y2%<0 Y2%=0
 2660 ?X%=Y1%:?(X%+1)=Y2%:?(X%+2)=0
 2670 NEXT
 2680 AX%=0
 2690 FOR X%=&5C00 TO &61FD STEP 3
 2700 AX%=AX%+1
 2710 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 2720 IF Y1%>5 Y1%=Y1%-1:GOTO 2760
 2730 NN%=RND(3)-2
 2740 Y1%=Y1%+NN%
 2750 IF Y1%<1 OR Y1%>5 Y1%=Y1%-NN%:GOTO 2730
 2760 IF AX%<3 OR ?X%<?(X%-3) OR ?X%<?(X%-6) GOTO 2790
 2770 IF RND(3+SS%*2)=1 AND AX%>4 ?(X%+2)=(RND(12)+3):AX
%=0:GOTO 2790
 2780 IF RND(3)=1 ?(X%+2)=1+RND(2):AX%=0
 2790 NEXT
 2800 Y1%=10:TX%=-1:AX%=0
 2810 FOR X%=&6200 TO &67FD STEP 3
 2820 TX%=TX%+1:AX%=AX%+1
 2830 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 2840 IF RND(7)=1 AND TX%>3 Y1%=RND(10)+4:TX%=0
 2850 IF AX%<3 OR TX%<3 GOTO 2890
 2860 IF RND(7)=1 ?(X%+2)=RND(2)+1:AX%=0:TX%=2:GOTO 2890
 2870 IF TX%<5 GOTO 2890
 2880 IF RND(4+SS%*5)=1 YY%=Y1%-4:?(X%-6)=YY%:?(X%-3)=YY
%:?X%=YY%:?(X%+2)=5:TX%=-1:AX%=0
 2890 NEXT
 2900 AX%=0
 2910 FOR X%=&67A0 TO &67FD STEP 3
 2920 AX%=AX%+1
 2930 ?X%=3:?(X%+1)=0:?(X%+2)=0
 2940 IF AX%>4 ?(X%+2)=5:AX%=0
 2950 NEXT
 2960 Y1%=15:Y2%=1:TX%=0:AX%=0
 2970 FOR X%=&6800 TO &6DFD STEP 3
 2980 TX%=TX%+1:AX%=AX%+1
 2990 ?X%=Y1%:?(X%+1)=Y2%:?(X%+2)=0
 3000 IF (TX%=40 OR(TX%>2 AND RND(15)=1)) AND Y1%+Y2%=16
Y1%=0:Y2%=0:TX%=0:AX%=-1
 3010 IF TX%>10-SS%*20 AND RND(5)=1 AND Y1%+Y2%>16 Y1%=
(RND(2)-1)*14+RND(3)-1:Y2%=16-Y1%:TX%=0:AX%=-1
 3020 IF AX%>2 AND RND(3)=1 AND Y1%+Y2%=16 AND X%<&6D80
?(X%+2)=2:AX%=0
 3030 NEXT
 3040 X%=&6[illegible]
 3050 TT$="[illegible]
bcc[illegible]
jbpbgh[illegible]bdcc[illegible]"
 3060 FOR J%=1 TO LEN(TT$) STEP 2
 3070 NO%=(ASC(MID$(TT$,J%,1)))-97
 3080 Y1%=(ASC(MID$(TT$,J%+1,1)))-97
 3090 IF NO%=99 END
 3100 FOR I%=1 TO NO%
 3110 ?X%=Y1%:?(X%+1)=0:?(X%+2)=0
 3120 X%=X%+3
 3130 NEXT
 3140 ENDPROC
```

BBC

A MOUNTAINOUS wasteland in magenta: the surface is littered with mystery bases, fuel dumps, loaded and unloaded missiles. As you race under the radar, your ship must destroy targets to gain points. Keep a watchful eye on your fuel: bombing or shooting fuel dumps will increase your fuel supply. You have to make sure your fuel tank is full before attempting the next sector.

This is the scenario that greets you in the first screen of Scrambler. The screen changes colour from magenta to red, as you enter the cave. The path of your attacking ship is blocked by bouncing fizzers. These evil creatures just bounce up and down whilst emitting a curious sound to help send you insane. Either try to shoot them down, or try to avoid them with some nifty finger work. A full tank of fuel is almost used up in this phase.

After vast fuel consumption in the cave you will be anxious to replenish your supply in this green-coloured rocky terrain. Fuel dumps and mystery bases occupy the ground, whilst fireball comets occupy the air space. The comets are indestructible, so the only way to survive is to dodge them.

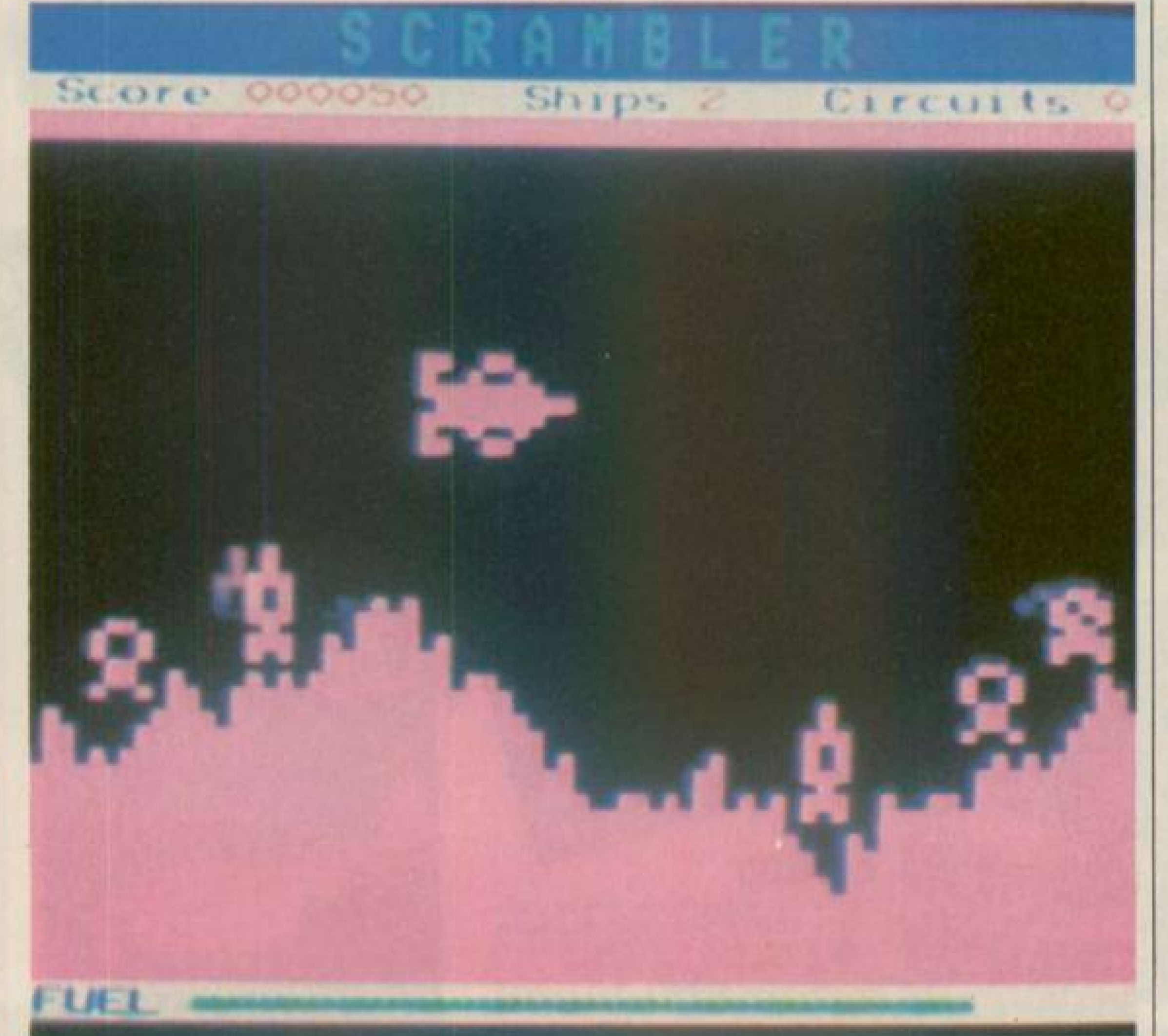
The screen turns blue as the deserted city approaches. This sector has all the hazards of the first one, with the enemy missiles in deep silos. The silhouette of the city at nightfall provides the background for all the action, the missiles coming fast and furious.

The fifth screen consists of large caverns joined by narrow passages being blocked by fuel dumps. Clever use of the boosters and retro rockets is the only way to survive this terrain.

A final colour change from yellow to cyan signals the start of the final sector, the Base. Flying over the futuristic skyline will bring you to the nerve centre of the enemy planet. A

SCRAMBLER

David Griffin's teletext Scrambler has the speed of machine code but is as easy to enter as Basic.



well-timed bomb on this headquarters will alter the military situation in favour of the human race.

When the sixth screen has been completed a bonus of 2,000 will be added to your score, and you are returned to the start for an even faster game.

I have written this game in mode 7 — teletext — for several reasons, firstly it is easier to write routines for right to left scrolling in this mode, there is more memory to work with than when using a high-resolution display and accessing the screen in machine code can be achieved with more speed and less difficulty than is the case with other modes.

The game is written using only one colour for each screen. To change the colour in teletext mode a control character is necessary. This would involve an extra gap before and after each part of the display requiring a different shade. This would mean added bulk to the already chunky display.

To get Scrambler into your machine you must do the following: type in listing 1, Save this using

SAVE "SCRAMBLER"

Type in listing 2, Save using

SAVE"SCRAMB"

To play the game Chain in the first program, and allow this one to Load and start the game itself.

Listing 1 is the initialising program. It contains all the necessary assembler, and it creates the data for the reproduction of the terrain. I have stored the information to draw the ground of the planet out of the way in memory so that the game can use the same planet each time the game is played. This also speeds up the game because the routines to print the relief do not have to mess around with random numbers and complex checking routines.

Listing 2 is the game and is loaded by the header program described above.

The listings are long and will take plenty of time and energy to type in. If you feel you do not have either the stamina or patience for such an epic, I will supply the game on cassette. Send £3 to David Griffin, 31 Apsley Road, Oldbury, Warley, West Midlands B68 0QY. ■

Listing 2. The game.

```
   10 REM     ... SCRAMB ...
   20
   30 REM Copyright (c) D.Griffin 1983
   40
   50
   60 MODE 7
   70 VDU 23,1,0;0;0;0;
   80 PROCINIT
   90 ON ERROR GOTO 100
  100 PROCINSTR
  110 PROCGAME
  120 PROCTABLE
  130 GOTO 110
  140 END
  150
  160
  170 DEFPROCINIT
  180 DIM HS%(8),H$(8)
  190 FOR I=1 TO 8
  200 HS%(I)=(9-I)*2000+RND(190)*10
  210 READ H$(I)
  220 NEXT
  230 DATA -=* the KING *=-,KILROY,RACH loves DAVE,JEDI-
KNIGHT,ee !!!,david griffin,Bruce & Sheila,Auntie BEEB
  240 SCROLL=&4800
  250 ROCKET=&4A1C
  260 PRI=&48A9
  270 RUB=&48FC
  280 RUBOUT=&4A40
  290 BOMB=&49FD
  300 MAN=&4929
  310 MBOUNCE=&480F
  320 BOUNCER=&4AEE
  330 CHECK=&496A
  340 MROCKETS=&4A64
  350 FIRE=&49CE
  360 ENVELOPE 1,1,130,95,50,126,126,126,126,0,0,-1,126,
100
  370 ENVELOPE 2,1,0,0,0,0,0,0,126,-1,-1,-1,100,80
  380 ENVELOPE 3,4,-4,-4,-4,126,126,126,126,-1,-2,-5,126
,100
  390 ENVELOPE 4,2,-1,-1,1,15,15,30,126,0,0,0,80,60
  400 ENDPROC
  410
  420 DEFPROCGAME
  430 CIRCUITS%=0
  440 LIVES%=3
  450 SECTOR%=1
  460 SCORE%=0
  470 XTRA%=1
  480 CLS
  490 PROCSCREEN
  500 ST%=-1
  510 REPEAT
  520 PROCSECTOR(SECTOR%)
  530 IF ?&75=0 SECTOR%=SECTOR%+1:ST%=0:ELSE PROCDEAD:ST
%=-1
  540 IF SECTOR%=7 PROCDONE
  550 UNTIL LIVES%=0
  560 PROCOVER
  570 ENDPROC
  580
  590 DEFPROCSECTOR(S%)
  600 IF S%=1 PROCPHASE1
  610 IF S%=2 PROCPHASE2
  620 IF S%=3 PROCPHASE3
  630 IF S%=4 PROCPHASE4
  640 IF S%=5 PROCPHASE5
  650 IF S%=6 PROCPHASE6
  660 ENDPROC
  670
  680 DEFPROCPHASE1
  690 PROCCOLOUR(149)
  700 IF ST% PROCTB(47,116)
  710 ?&7A=47
  720 NN%=&5000
  730 REPEAT
  740 ?&79=(RND(2)-1)*4+116
  750 PROCDO(NN%)
  760 NME%=?(NN%+2)
  770 IF NME%=1 OR NME%=5 PROCROCKET(&7F45-?NN%*40)
  780 IF NME%=2 PROCFUELDUMP(?NN%)
  790 IF NME%=3 PROCMYSTERY(?NN%)
  800 IF NME%=5 PROCNROCKET
  810 NN%=NN%+3
  820 UNTIL NN%>&55FD OR ?&75=1
  830 ENDPROC
  840
  850 DEFPROCPHASE2
  860 SOUND 1,4,150,1
  870 PROCCOLOUR(145)
  880 IF ST% PROCTB(39,116)
  890 NN%=&5600
  900 REPEAT
  910 ?&79=(RND(2)-1)*4+116
  920 ?&7A=(RND(2)-1)*4+39
  930 PROCDO(NN%)
  940 IF ?(NN%+2)=4 PROCNBOUNCER
  950 NN%=NN%+3
  960 UNTIL NN%>&5BFD OR ?&75=1
  970 SOUND 1,0,1,1
  980 ENDPROC
  990
 1000 DEFPROCPHASE3
 1010 PROCCOLOUR(146)
 1020 IF ST% PROCTB(47,116)
 1030 ?&7A=47
 1040 NN%=&5C00
 1050 REPEAT
 1060 ?&79=(RND(2)-1)*4+116
 1070 PROCDO(NN%)
 1080 NME%=?(NN%+2)
 1090 IF NME%=2 PROCFUELDUMP(?NN%)
 1100 IF NME%=3 PROCMYSTERY(?NN%)
 1110 IF NME%>4 PROCFBALL(NME%)
 1120 NN%=NN%+3
 1130 UNTIL NN%>&61FD OR ?&75=1
 1140 ENDPROC
 1150
 1160 DEFPROCPHASE4
 1170 PROCCOLOUR(148)
 1180 IF ST% PROCTB(47,124)
 1190 ?&79=124
 1200 ?&7A=47
 1210 NN%=&6200
 1220 REPEAT
 1230 PROCDO(NN%)
 1240 NME%=?(NN%+2)
```

(continued on page 93)

HEWSON CONSULTANTS

Items from this advertisement **are available through W.H. Smiths,** larger branches of Boots and all leading micro computer retailers.

SPECVADERS

16K Spectrum.
Defeat each squadron of Beeple Zaps and another appears only closer. Cyrias mothership with ejecting Zeetle Saps.
5 levels of play from Orions snail's pace to close your eyes and hope. Real time scoring. 3 lives. Pan galactic gargle blaster for highest score. Descending asteroids.

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For the 16K Spectrum.
YOUR TASK: to direct incoming aircraft from holding stacks to runway – smoothly, safely and expeditiously.
YOUR INSTRUMENTS: Radar screen showing aircraft call signs, blips and trails. Four stack displays giving altitude, heading, speed and size.
SEVEN levels of play including a demonstration mode.
FEATURES: mixed aircraft, restricted airspace, minimum separation, outbound traffic, emergencies, unknown aircraft, radio failure, loss of a runway, instrument failure . . .

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NIGHTFLITE puts you at the controls *of a light aircraft flying at night.* You can: climb, descend, take off, land, bank left or right, navigate between beacons, raise/lower the flaps, raise/lower the undercarriage, adjust engine rpm, raise/lower the nose varying amounts.

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For the 16K Spectrum.
8 levels of play from novice to expert. Full colour display of tables and dice. Gamble on a single game or a series, double or quits. All the features of the ancient game.

£5.95

QUEST

Explore the dense forest, gloomy castle, maze and mountains, confront the dwarves, elves, dragon and centaur. Your QUEST is to locate the ancient scroll. An enthralling adventure for the 48K Spectrum.

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YC8

(continued from page 91)

```
1250 IF NMEX=2 PROCFUELDUMP(?NN%)
1260 IF NMEX=3 PROCMYSTERY(?NN%)
1270 IF NMEX=5 PROCROCKET(&7F45-?NN%*40):PROCNROCKET
1280 NN%=NN%+3
1290 UNTIL NN%>&67FD OR ?&75=1
1300 ENDPROC
1310
1320 DEFPROCPHASE5
1330 PROCCOLOUR(147)
1340 IF ST% PROCTB(47,124)
1350 ?&79=124
1360 ?&7A=47
1370 NN%=&6B00
1380 REPEAT
1390 PROCDO(NN%)
1400 IF ?(NN%+2)=2 PROCFUELDUMP(?NN%)
1410 NN%=NN%+3
1420 UNTIL NN%>&60FD OR ?&75=1
1430 ENDPROC
1440
1450 DEFPROCPHASE6
1460 PROCCOLOUR(150)
1470 IF ST% PROCTB(47,124)
1480 ?&79=124
1490 ?&7A=47
1500 NN%=&6E00
1510 REPEAT
1520 PROCDO(NN%)
1530 NN%=NN%+3
1540 IF NN%=&6F90 PROCBASE
1550 IF NN%>&7081 NN%=&6E00
1560 UNTIL ?&75=1 OR HIT%=1
1570 ENDPROC
1580
1590 DEFPROCDO(LOC%)
1600 TTT=TIME
1610 FUEL%=FUEL%-1
1620 IF FUEL%<0 ?&75=1
1630 IF FUEL%<50 AND FUEL% MOD 6=1 SOUND 1,-15,200,3:SO
UND 1,-10,100,3
1640 IF FUEL% MOD 22=0 PROCFUEL
1650 ?&80=?LOC%
1660 ?&82=LOC%?1
1670 IF ?&74=1 TPS%=?&72+256*?&73:?TPS%=32:IF (TPS%-HIM
EM)MOD 40>34 ?&74=0
1680 IF ?&78=1 ?(?&76+256*?&77)=32
1690 CALL RUB
1700 CALL SCROLL
1710 CALL PRI
1720 PROCMAN
1730 CALL MROCKETS
1740 CALL MBOUNCE
1750 CALL CHECK
1760 IF ?&75=1 PROCCRASH(YY%):ENDPROC
1770 CALL MAN
1780 IF ?&74=1 CALL FIRE:IF ?&74=0 PROCMISSSTOP
1790 IF ?&78=1 CALL BOMB:IF ?&78=0 PROCBOMBSTOP
1800 REPEAT UNTIL TIME>TTT+SKILL%
1810 ENDPROC
1820
1830 DEFPROCSCREEN
1840 VDU 31,0,0,132,157,134,141,31,12,0:PRINT "S C R A
M B L E R"
1850 VDU 31,0,1,132,157,134,141,31,12,1:PRINT "S C R A
M B L E R"
1860 VDU 31,1,2,157,132:PRINT "Score";CHR$129;"000000";
CHR$132;"  Ships";CHR$129;LIVES%-1;CHR$132;"  Circuits";
CHR$129;CIRCUIT%;
1870 VDU 31,0,24,154,157,133:PRINT "FUEL";CHR$150;
1880 FOR I=&50 TO &80
1890 ?I=0
1900 NEXT
1910 RR%=0
1920 BOUNCE%=0
1930 FUEL%=600
1940 BB%=1
1950 ROCK%=0
1960 YY%=&7EDF
1970 ?&50=&98
1980 ?&51=&7D
1990 HIT%=0
2000 PROCSCORE
2010 PROCFUEL
2020 ENDPROC
2030
2040 DEFPROCMAN
2050 DD%=0
2060 IF INKEY-66 YY%=YY%-40
2070 IF INKEY-98 YY%=YY%+40
2080 IF INKEY-1 DD%=1
2090 IF INKEY-99 DD%=-1
2100 YY%=YY%+DD%
2110 TYY%=(YY%-HIMEM) MOD 40
2120 IF TYY%<7 OR TYY%>24 YY%=YY%-DD%
2130 ?&50=YY%:?&51=YY% DIV 256
2140 IF ?&74=0 IF INKEY-74 ?&74=1:TT%=YY%+45:?&72=TT%:?
&73=TT% DIV 256
2150 IF ?&78=0 IF INKEY-97 SOUND 2,3,150,1:?&78=1:TT%=Y
Y%+82:?&76=TT%:?&77=TT% DIV 256
2160 ENDPROC
2170
2180 DEFPROCMISSSTOP
2190 PO%=?&72+256*?&73
2200 IF ?PO%=32 PO%=PO%+1:GOTO 2200
2210 IF ?PO%>127 ENDPROC
2220 IF SECTOR%<>6 PROCCHECKALIEN
2230 ENDPROC
2240
2250 DEFPROCBOMBSTOP
2260 PO%=?&76+256*?&77
2270 IF ?PO%>127 ENDPROC
2280 IF SECTOR%<>6 PROCCHECKALIEN ELSE PROCCHECKBASE
2290 ENDPROC
2300
2310 DEFPROCCHECKALIEN
2320 IF ?(PO%+1)=59 PROCRUBOUT(PO%,2):PROCSC1:ENDPROC
2330 IF ?PO%=104 AND ?(PO%+1)=47 PROCRUBOUT(PO%-40,2):P
ROCSC1:ENDPROC
2340 IF ?PO%=59 PROCRUBOUT(PO%-1,2):PROCSC1:ENDPROC
2350 IF ?PO%=47 AND ?(PO%-1)=104 PROCRUBOUT(PO%-41,2):P
ROCSC1:ENDPROC
2360 IF ?(PO%-1)=59 PROCRUBOUT(PO%-2,2):PROCSC1:ENDPROC
2370 IF ?(PO%+1)=35 PROCRUBOUT(PO%,2):PROCSC2:ENDPROC
2380 IF ?PO%=96 AND ?(PO%+1)=47 PROCRUBOUT(PO%-40,2):PR
OCSC2:ENDPROC
2390 IF ?PO%=35 PROCRUBOUT(PO%-1,2):PROCSC2:ENDPROC
2400 IF ?PO%=47 AND ?(PO%-1)=96 PROCRUBOUT(PO%-41,2):PR
OCSC2:ENDPROC
2410 IF ?(PO%-1)=35 PROCRUBOUT(PO%-2,2):PROCSC2:ENDPROC
2420 IF ?(PO%+1)=117 PROCRUBOUT(PO%,3):PROCSC3:ENDPROC
2430 IF ?(PO%+1)=122 PROCRUBOUT(PO%-40,3):PROCSC3:ENDPR
OC
2440 IF ?(PO%+1)=109 PROCRUBOUT(PO%-80,3):PROCSC3:ENDPR
OC
2450 IF ?PO%=117 AND ?(PO%-1)=96 PROCRUBOUT(PO%-1,3):PR
OCSC3:ENDPROC
2460 IF ?(PO%-1)=106 PROCRUBOUT(PO%-41,3):PROCSC3:ENDPR
OC
2470 IF ?PO%=109 AND ?(PO%-1)=104 PROCRUBOUT(PO%-81,3):
PROCSC3:ENDPROC
2480 IF ?(PO%+1)=111 PROCRUBOUT(PO%,2):PROCSC4:ENDPROC
2490 IF ?PO%=34 AND ?(PO%+1)=47 PROCRUBOUT(PO%-40,2):PR
OCSC4:ENDPROC
2500 ENDPROC
2510
2520 DEFPROCSC1
2530 SOUND 0,2,RND(3)+3,1
2540 SCORE%=SCORE%+25
2550 FUEL%=FUEL%+25
2560 IF FUEL%>660 FUEL%=660
2570 PROCSCORE
2580 PROCFUEL
2590 ENDPROC
2600
2610 DEFPROCSC2
2620 SOUND 0,2,RND(3)+3,1
2630 SCORE%=SCORE%+RND(3)*50
2640 PROCSCORE
2650 ENDPROC
2660
2670 DEFPROCSC3
2680 SOUND 0,2,RND(3)+3,1
2690 SCORE%=SCORE%+50
2700 PROCSCORE
2710 ENDPROC
2720
2730 DEFPROCSC4
2740 SOUND 0,2,RND(3)+3,1
2750 SCORE%=SCORE%+75
2760 PROCSCORE
2770 ENDPROC
2780
2790 DEFPROCSCORE
2800 PRINT TAB(7,2);RIGHT$("000000"+STR$(SCORE%),6)
2810 IF SCORE%>=10000 AND XTRA%=1 LIVES%=LIVES%+1:XTRA%
=0:SOUND 3,-15,96,10:SOUND 3,-15,48,10:SOUND 3,-15,96,10
:PRINT TAB(24,2);LIVES%-1
2820 ENDPROC
2830
2840 DEFPROCFUEL
2850 PRINT TAB(8,24);STRING$(FUEL% DIV 22,",");" ";
2860 ENDPROC
2870
2880 DEFPROCRUBOUT(SCREEN%,DOWN%)
2890 ?&57=DOWN%-1
2900 ?&58=SCREEN%
2910 ?&59=SCREEN% DIV 256
2920 CALL RUBOUT
2930 ENDPROC
2940 ENDPROC
2950 DEFPROCCHECKBASE
2960 IF ?PO%=255 OR ?PO%=47 OR ?PO%=124 ENDPROC
2970 HIT%=1
2980 ENDPROC
2990
3000 DEFPROCDONE
3010 SOUND 1,1,1,75
3020 SOUND 2,1,1,75
3030 SOUND 3,1,1,75
3040 FOR DEL=1 TO 2000:NEXT
3050 CLS
3060 FOR II%=3 TO 4
3070 VDU 31,3,II%,141:PRINT " C O N G R A T U L A T I O
N S"
3080 VDU 31,7,II%+6,141,132,157,131:PRINT " Y o u   H a
v e  ";CHR$ 156
3090 VDU 31,7,II%+8,141,132,157,131:PRINT "C o m p l e
t e d  ";CHR$ 156
3100 VDU 31,7,II%+10,141,132,157,131:PRINT "Y o u r   R
a i d  ";CHR$ 156
3110 VDU 31,5,II%+17,141,129:PRINT "N o w   T r y   A g
a i n"
3120 NEXT
3130 VDU 31,8,8,132,157,31,30,8,156,31,8,15,132,157,31,
30,15,156
3140 COL%=0
3150 FOR J=1 TO 50
3160 FOR I=4 TO 32 STEP 2
3170 VDU 31,I,3,COL% MOD 7+129,31,I,4,COL% MOD 7+129
3180 COL%=COL%+1
3190 NEXT,
3200 CIRCUIT%=CIRCUIT%+1
3210 SECTOR%=1
3220 SCORE%=SCORE%+2000
3230 SKILL%=5
3240 CLS
3250 PROCSCREEN
3260 ENDPROC
3270
3280 DEFPROCFUELDUMP(YPOS%)
3290 YP%=21-YPOS%
3300 VDU 31,37,YP%,104,59,52,31,37,YP%+1,104,47,52
3310 ENDPROC
3320
3330 DEFPROCMYSTERY(YPOS%)
3340 YP%=21-YPOS%
3350 VDU 31,37,YP%,104,96,52,31,37,YP%+1,95,47,48
3360 ENDPROC
3370
3380 DEFPROCFBALL(YPOS%)
3390 VDU 31,36,YPOS%,126,119,100,40,31,36,YPOS%+1,43,46
,33,36
3400 ENDPROC
3410
3420 DEFPROCROCKET(MPOS%)
3430 ?&55=MPOS%
3440 ?&56=MPOS% DIV 256
3450 CALL ROCKET
3460 ENDPROC
3470
3480 DEFPROCNROCKET
3490 ROCK%?&90=1
3500 ROCK%?&91=RND(14)+5
3510 ROCC%=&7F45-?NN%*40
3520 ROCK%?&92=ROCC%
3530 ROCK%?&93=ROCC% DIV 256
3540 ROCK%=ROCK%+4
3550 IF ROCK%=28 ROCK%=0
3560 ENDPROC
3570
3580 DEFPROCNBOUNCER
3590 BNC%=&7EA5-?NN%*40
3600 ?&5B=BNC%
3610 ?&5C=BNC% DIV 256
3620 CALL BOUNCER
3630 BOUNCE%?&83=BNC%
3640 BOUNCE%?&84=BNC% DIV 256
3650 BOUNCE%=BOUNCE%+3
3660 IF BOUNCE%=9 BOUNCE%=0
3670 ENDPROC
3680
3690 DEFPROCDEAD
3700 LIVES%=LIVES%-1
3710 ?&75=0
3720 FOR DEL=1 TO 3000:NEXT
3730 IF LIVES%<>0 CLS:PROCSCREEN
3740 ENDPROC
3750
3760 DEFPROCCOLOUR(COL%)
3770 FOR I%=&7C78 TO &7F98 STEP 40
3780 ?I%=COL%
3790 NEXT
3800 ENDPROC
3810
3820 DEFPROCCRASH(S%)
3830 SOUND 1,0,0,1
3840 CALL MAN
3850 SOUND 0,0,0,7:SOUND 0,2,6,4:SOUND 0,2,6,15:SOUND 0
,2,6,5
3860 TCOL%=?&7CF0
3870 FOR I=1 TO 5
3880 PROCCOLOUR(RND(7)+144)
3890 CALL RUB
3900 FOR DEL=1 TO 150:NEXT
3910 CALL MAN
3920 FOR DEL=1 TO RND(150)+50
3930 NEXT,
3940 !S%=&6068302B
3950 S%!40=&3DFF6E28
3960 S%!80=&222521 2B
3970 S%?4=&24
3980 S%?44=&24
3990 S%?84=&24
4000 FOR COL=145 TO 151
4010 PROCCOLOUR(COL)
4020 FOR DEL=1 TO RND(300)+50:NEXT,
4030 PROCCOLOUR(TCOL%)
4040 ENDPROC
4050
4060 DEFPROCBASE
4070 VDU 31,36,20,56,99,41,31,36,21,101,43,99,31,36,22,
95,63,117
4080 ENDPROC
4090
4100 DEFPROCTB(T%,B%)
4110 PRINT TAB(1,3);STRING$(39,CHR$T%)
4120 PRINT TAB(1,23);STRING$(39,CHR$B%);
4130 ENDPROC
4140
4150 DEFPROCOVER
4160 VDU 28,1,23,39,3,12,26
4170 PRINT TAB(38,2);" "
4180 PROCCOLOUR(151)
4190 PRINT TAB(13,8);"pppppppppppppp"
4200 PRINT TAB(13,9);"5(,,,,,,,,,,,,1j"
4210 PRINT TAB(13,10);"55& &&'4=05m3jj"
4220 PRINT TAB(13,11);"55w!7'55!5upjj"
4230 PRINT TAB(13,12);"55_p 0 0up_p0jj"
4240 PRINT TAB(13,13);"555 5ih'=#jpjjj"
4250 PRINT TAB(13,14);"55!,! % -,* *jj"
4260 PRINT TAB(13,15);"uuuuuuuuuuuuuuz"
4270 FOR I=1 TO 3
4280 FOR COL=145 TO 151
4290 PROCCOLOUR(COL)
4300 FOR DEL=1 TO 50:NEXT
4310 NEXT,
4320 ENDPROC
4330
4340 DEFPROCTABLE
4350 *FX 15,0
4360 CLS
4370 IF SCORE%<H%(8) GOTO 4500
4380 PROCFTBL
4390 VDU 23,1,1;0;0;0;
4400 PRINT TAB(0,22);"You scored ";RIGHT$("000000"+STR$
(SCORE%),6)
4410 INPUT TAB(0,23)"Enter your name ... "H$(8)
4420 H$(8)=LEFT$(H$(8),20)
4430 VDU 23,1,0;0;0;0;
4440 CLS
4450 H%(8)=SCORE%
4460 FOR I=1 TO 8
4470 FOR J=2 TO 8
4480 IF H%(J)>=H%(J-1) T%=H%(J):H%(J)=H%(J-1):H%(J-1)=T
%:T$=H$(J):H$(J)=H$(J-1):H$(J-1)=T$
4490 NEXT,
4500 PROCFTBL
4510 VDU 31,8,23,131:PRINT "Press";CHR$136;"SPACE BAR";
CHR$137;"to play"
4520 REPEAT UNTIL GET=32
4530 ENDPROC
4540
4550 DEFPROCFTBL
4560 VDU 31,4,0,145,232:PRINT STRING$(27,CHR$172);CHR$1
80
4570 VDU 31,3,1,141,145,234,132,83,134,67,132,82,134,65
,132,77,134,66,132,76,134,69,132,82,131:PRINT " scores";
CHR$145;CHR$181
4580 VDU 31,3,2,141,145,234,132,83,134,67,132,82,134,65
,132,77,134,66,132,76,134,69,132,82,131:PRINT " scores";
CHR$145;CHR$181
4590 VDU 31,4,5,145,170:PRINT STRING$(27,CHR$172);CHR$1
65
4600 FOR I=1 TO 8
4610 VDU 31,4,I*2+4,(I-1) MOD 7+129
4620 PRINT ;I;")  ";RIGHT$("000000"+STR$(H%(I)),6);" ..
. ";H$(I)
4630 NEXT
4640 ENDPROC
4650
4660 DEFPROCINSTR
4670 CLS
4680 FOR I=0 TO 1:VDU 31,0,I,134,157,31,39,I,156:NEXT
4690 FOR I=2 TO 7:VDU 31,0,I,132,157,150,31,39,I,156:NE
XT
4700 FOR I=8 TO 10:VDU 31,0,I,134,157,132,31,39,I,156:N
EXT
4710 PRINT TAB(3,2);"     _ppp0  _ppp0   pppp   _ppp"
4720 PRINT TAB(3,3);" h!,!j!vB(.!j!&5!,!4B!khl!j"h,!4"
4730 PRINT TAB(3,4);" ju/"!j?55/z!_0554455!k!j";CHR$255
;"jh"j#w5 "
4740 PRINT TAB(3,5);" j7-jjt+55 jjzu5555up"j*ojpzjh45
"
4750 PRINT TAB(3,6);" */,/   ,-'.   ,---%  !.,.  !..-%
"
4760 PRINT TAB(4,9);"Copyright (c) David Griffin 1983"
4770 VDU 31,3,13,133:PRINT "Controls :-"
4780 VDU 31,17,13,129:PRINT "A ";CHR$131;"Up"
4790 VDU 31,17,14,129:PRINT "Z ";CHR$131;"Down"
4800 VDU 31,13,15,129:PRINT "SHIFT ";CHR$131;"Forwards"
4810 VDU 31,9,16,129:PRINT "SPACE BAR ";CHR$131;"Backwa
rds"
4820 VDU 31,12,17,129:PRINT "RETURN ";CHR$131;"Fire Mis
sile"
4830 VDU 31,15,18,129:PRINT "TAB ";CHR$131;"Drop Bomb"
4840 VDU 31,12,19,129:PRINT "ESCAPE ";CHR$131;"Start Ag
ain"
4850 VDU 31,3,22,133:PRINT "Press :-      ";CHR$129;"I "
;CHR$131;"for INSTRUCTIONS"
4860 VDU 31,17,23,129:PRINT "S ";CHR$131;"to START"
4870 REPEAT A$=GET$
4880 UNTIL A$="I" OR A$="S"
4890 PRINT TAB(3,22);SPC(80);
4900 IF A$="I" PROCI
4910 VDU 31,10,23,130:PRINT "Which speed level ?"
4920 VDU 31,8,24,130:PRINT "(1 (slow) to 3 (fast))";
4930 REPEAT A$=GET$
4940 UNTIL A$="1" OR A$="2" OR A$="3"
4950 SKILL%=(3-VAL(A$))*2+6
4960 SOUND 1,-15,96,3
4970 SOUND 1,-15,48,2
4980 SOUND 1,-15,144,5
4990 PRINT TAB(0,23);SPC(75);
5000 VDU 31,8,23,130:PRINT "Press";CHR$136;"SPACE BAR";
CHR$137;"to play"
5010 REPEAT UNTIL GET=32
5020 ENDPROC
5030
5040 DEFPROCI
5050 CLS
5060 VDU 31,1,0,132,157,31,39,0,156
5070 VDU 31,0,1,141,132,157,134:PRINT " S C R A M B L E
R ";CHR$131;"instructions   ";CHR$156
5080 VDU 31,0,2,141,132,157,134:PRINT " S C R A M B L E
R ";CHR$131;"instructions   ";CHR$156
5090 VDU 31,1,3,132,157,31,39,3,156
5100 VDU 31,2,6,145:PRINT "_u"
5110 VDU 31,2,7,145:PRINT "jz"
5120 VDU 31,2,8,145:PRINT "hm   ";CHR$131;"Enemy Missil
e ....";CHR$134;"50 points"
5130 VDU 31,2,10,145:PRINT "h;4"
5140 VDU 31,2,11,145:PRINT "h/4  ";CHR$131;"Fuel Dump .
.......";CHR$134;"25 points"
5150 VDU 31,2,13,145:PRINT "h'4"
5160 VDU 31,2,14,145:PRINT "_/0  ";CHR$131;"Mystery Bas
e .....";CHR$134;"?? points"
5170 VDU 31,2,16,145:PRINT "hom"
5180 VDU 31,2,17,145,34,47,39,32,32,131:PRINT "Bounce F
izzer ....";CHR$134;"75 points"
5190 ENDPROC
```

VIC–2
ATTAC

Program 2.

```
10 PRINT"■":POKE55,0:POKE56,28:CLR
100 FORZ=7168TO7679:READX:POKEZ,X:NEXT:FORZ=673TO751:READX:POKEZ,X:NEXT
200 DATA254,254,146,146,146,146,254,254,146,254,146,254,146,254,146,254,254,(
254,254
210 DATA254,68,254,254,254,170,170,170,170,170,170,254,,16,16,56,56,124,254,2
,16,56
220 DATA56,254,170,254,170,254,16,16,16,56,56,254,130,254,16,16,16,56,124,124
54,254
240 DATA,108,108,108,108,254,254,254,,36,60,24,36,60,24,
250 DATA255,255,136,85,34,255,255,,,,,,2,142,238,254,,,,,,18,86,246
260 DATA,,,8,10,94,126,254,,,2,130,138,218,222,254
270 DATA,,,,128,146,214,246,,,,128,192,200,202,238
280 DATA,,219,146,210,82,219,,,,179,170,179,170,171,,,,87,82,114,82,87,
290 DATA,,117,69,87,85,117,
300 DATA124,254,198,186,254,214,214,124,124,186,198,254,214,214,254,124
320 DATA,233,137,137,233,137,137,134,,116,68,68,116,68,68,119
340 DATA3,15,60,127,201,127,63,8,128,224,120,252,38,252,248,32
360 DATA1,,8,36,125,40,5,,,80,129,40,64,26,64,43
380 DATA0,34,136,6,32,10,,18,64,,32,132,32,138,32,
400 DATA,,,,,,,,,,,,,,,,
420 DATA153,153,126,24,60,36,66,195,24,24,126,153,60,36,36,102
440 DATA3,2,34,2,2,2,34,3
450 DATA255,,255,255,255,255,,255,255,,254,254,254,254,,255
460 DATA255,,252,252,252,252,,255,255,,248,248,248,248,,255
470 DATA255,,240,240,240,240,,255,255,,224,224,224,224,,255
480 DATA255,,192,192,192,192,,255,255,,128,128,128,128,,255
510 DATA255,,,,,,,255,,,154,146,154,146,217,
550 DATA,,180,164,180,164,54,,255,141,185,141,189,189,189,255
570 DATA56,108,198,198,198,108,56,,24,120,24,24,24,24,126,
580 DATA124,198,6,12,56,96,254,,124,198,6,28,6,198,124,
590 DATA28,60,116,230,254,12,12,,254,192,252,6,6,198,124,
600 DATA60,96,192,252,198,198,124,,254,198,12,24,48,96,96,
610 DATA124,198,198,124,198,198,124,,124,198,198,126,6,12,120,,,,,32,,,32,
620 DATA255,136,186,138,232,235,139,255,255,140,171,171,139,171,172,255
640 DATA255,199,95,199,223,95,199,255
660 DATA255,239,223,129,223,239,255,255,192,160,160,192,14,21,21,21
1010 DATA120,169,174,141,20,3,169,2,141,21,3,88,96,230,254,165,254,41,16,74,170
,160,8,189
1020 DATA168,28,153,247,28,232,136,208,246,165,197,201,8,208,37,160,,140,14,144
,32,159,255
1030 DATA165,197,201,8,240,247,32,159,255,165,197,201,8,208,247,32,159,255,165,
197,201,8
1040 DATA240,247,160,15,140,14,144,76,77,1
2000 FORZ=319TO414:READX:POKEZ,X:NEXT:FORZ=0TO73:READX,Y:POKE37888+Z,X:POKE3814
4+Z,Y:NEXT
2010 DATA162,,169,32,157,52,30,157,186,30,202,208,247,96
2020 DATA165,1,240,3,206,12,144
2030 DATA165,,240,57,198,249,208,53,173,10,144,201,127,240,12,230,249
2035 DATA169,127,141,10,144,141,11,144
2040 DATA208,34,166,250,230,250,169,15,61,,148,10,10,10,10,133,248
2045 DATA169,15,61,,149
2050 DATA101,248,240,13,141,11,144,141,10,144,169,7,133,249,76,194,234,169,,13
3,249
2060 DATA169,,133,250,76,194,234
3010 DATA12,3,12,3,12,12,12,14,13,7,13,7,12,12,12,14,12,3,12,3,12,12,12,14,13,7
,13,7
3015 DATA12,15,13,7,13,1
3020 DATA13,1,13,8,13,11,14,1,14,1,13,8,13,11,13,1,13,1,13,8,13,9,14,1,14,1,13,
9,14,1
3030 DATA13,7,13,7,13,13,13,15,14,4,14,4,13,15,13,7,13,1,13,1,13,8,13,10,14,1,1
4,1,13,10
3040 DATA13,1,12,3,12,3,12,12,12,14,13,7,13,7,12,11,12,13,13,7,13,7,13,1,13,1,1
2,15,12
3050 DATA15,12,9,12,9,,,11,7,11,7,10,15,10,15,10,3,10,3,9,15,9,15,,
3060 POKE198,7:POKE631,76:POKE632,207:POKE633,13:POKE634,82:POKE635,213:POKE636
,13
```

Program 3. The game.

```
5 POKE37150,2
10 PRINTCHR$(8):CLR:B=1000:GOTO10000
20 POKE36879,8:PRINT"J"CHR$(8):CLR:B=5000:GOTO10000
50 IFS>=1000ANDC1=0THENC1=1:L=L+1:POKE38889+L,5:POKE8169+L,31
60 PRINT"▲"TAB(9-LEN(STR$(S)))RIGHT$(STR$(S),LEN(STR$(S))-1):RETURN
100 IFM>8095THENRETURN
103 IFPEEK(K)=JANDC=0THENGOSUB20000:RETURN
105 IFPEEK(8151)=44THEND1=1:POKEE,0:GOSUB20000:RETURN
110 IFO=0THENPOKEV-E,240:O=E:N=M+E:POKEV-2,235:POKEE,E:POKEV-E,0:GOSUB1500:IFA5
=ETHENRETURN
120 N=N+D:IFPEEK(N)<>ITHENPOKEE,0:POKEV-2,0:GOTO160
130 IFPEEK(N-D)<>DANDPEEK(N-D)<>25THENPOKEN-D,I
140 POKEN+C,P:POKEN,0:RETURN
150 POKEN-D,I:POKEN+C,P:POKEN,0:RETURN
160 IFN+D<8122THENPOKEN+D,RND(E)*6+11
170 IFPEEK(N)<>A2THENPOKEN,I:S=S+2*W
180 IFPEEK(N-D)<>DANDPEEK(N-D)<>25THENPOKEN-D,I
190 POKEV-E,130
200 GOSUB50:O=0:POKEV-E,0:N=A3:RETURN
1000 POKEM,I:M=M+E:IFM=8107THENA6=E
1010 POKEC+M,F:POKEH+M,F:POKEM,D-E:POKEM+E,D:IFPEEK(M+2)=ITHENRETURN
1020 B1=I:RETURN
1500 IFPEEK(8151)=44THENA7=1:RETURN
1510 IFA8=1THEN1530
1520 A5=A5+1:IFA5>2THENA5=0:RETURN
1530 POKEA4,PEEK(A4)+1:IFPEEK(A4)=44THENA4=A4-1
1540 RETURN
2000 POKEV-2,0
2005 POKEN,I:POKEV-E,138:POKE0,0:POKEV-3,0:POKEM,I:POKEM+E,I:M=M+E:FORT=252TO12
8STEP-4
2010 POKEV-E,T:POKEV-T,4:R=RND(1)*15+E:POKEM+C,R:POKEM+H,R:POKEM,27:R=RND(1)*15
+E
2020 B1=0:POKEM+E,28:POKEM+C,R:POKEM+H,R:POKEM,29:POKEM+E,30:NEXT:POKEM,I:POKEM
+E,I
2025 IFD1<>1THENPOKEM+27,RND(1)*6+11
2030 POKEV+E,8:FORT=15TO0STEP-.1:POKEV,T:NEXT:L=L-1:POKE8170+L,I
```

(continued on page 99)

YOU ARE an alien in a crippled flying saucer and as you gradually descend you must destroy the buildings blocking your approach by dropping your limited supply of energy pods.

Flying Saucer Attack packs an amazing amount of game into the 3.5K of the unexpanded Vic-20 by using a hybrid mixture of Basic and machine code. Features of the game include nine levels of play, high score, fuel bonus, animated faces and 64 user-defined characters. The program also plays three different tunes.

To achieve all this in 3.5K means having three programs. The first program is simply a title screen and may be omitted. By far the biggest program in terms of complexity is program 2. This contains the 64 hi-res characters, the data for two of the tunes and the five machine-code routines, most of which are primarily concerned with sound. This program just fits into 3.5K and must be typed in exactly as shown. The large number of commas together represent zeros and must be included.

This program must be saved and carefully verified as the tiniest mistake could lead to a crash or out of memory error. Take care keying in this program. Some of the lines are over 88 characters long, so use the abbreviated form of Data, that is, D shift A.

Doomsday boogie

The Data for the tune is stored in a novel fashion. It is held in unused colour memory. As can be seen from program 2, the Data is Poked into some strange locations, notably the stack and the free locations 673 to 767. By utilising these free locations the program has managed to do in 3.5K what would usually take 4.5K of user memory.

Again program 3, the game itself, must be typed in with extreme caution. Over 40 variables are used and yet again some lines may be over 88 characters. The screen is a rectangular 26×19 as dictated by line 10000. The scores are print-formatted as well, to give a professional result.

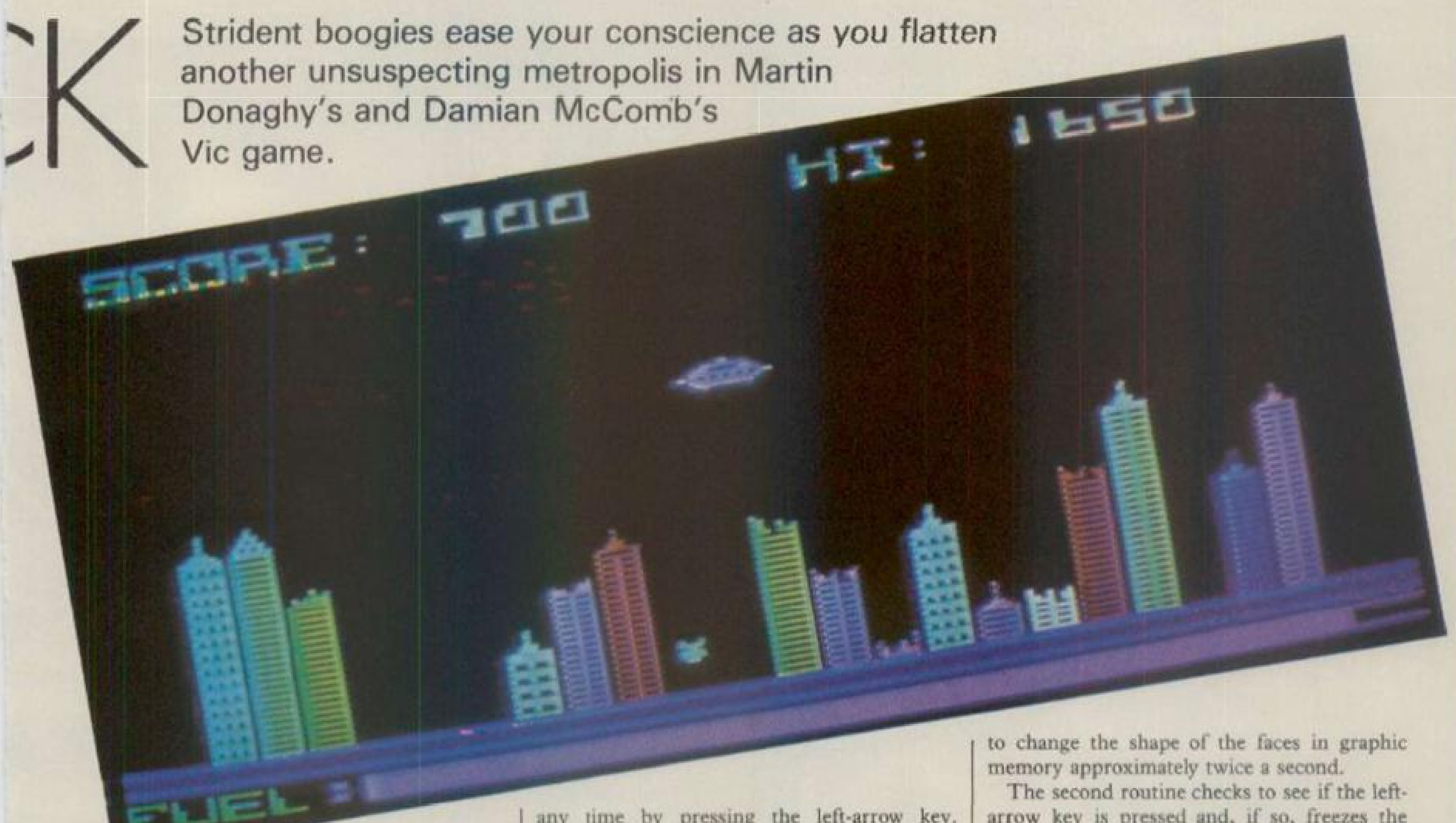
We must stress that this program must not be run until it is checked and saved. Line 5 disables the Run Stop key and Restore. This may be omitted if you plan to modify the program as described later.

If you have saved all three programs and thoroughly tested them you may now run the three of them together. Each program automatically loads the next on Running.

At the start of the game, instructions are

FLYING SAUCER

Strident boogies ease your conscience as you flatten another unsuspecting metropolis in Martin Donaghy's and Damian McComb's Vic game.



printed over the main display while three green heads smile and frown in unison with an over-enthusiastic boogie tune threatening to burst out of your bulging TV speaker.

The instructions are fairly simple. The space bar selects the game level which is constantly displayed at the top of the screen.

F1 starts the game. The screen is immediately cleared using a machine-code routine and a multicoloured city appears before your eyes. Your ship gradually loses altitude as you frantically drop energy pods to the accompaniment of the ominous wail of an ailing electro-harmonic impulse drive.

Almost any key can be used to fire and the fuel supply depletes accordingly. An extra feature of the game is the ability to Pause at any time by pressing the left-arrow key. Pressing this key again restarts the game.

If you run out of fuel you explode and naturally lose a life. Hitting a building has the same effect. If you manage to clear a city you are given a bonus for the amount of energy remaining. As well as this, a little man jumps out of the UFO and jumps for joy. The size of building increases with each city you manage to destroy.

Flattening object

A free UFO is awarded after 10,000 points which is also the minimum high score which the program will record.

There are many more extras which go to make this game well worth the trouble of keying in.

The machine-code routines are fairly complicated. The first routine uses a counter to change the shape of the faces in graphic memory approximately twice a second.

The second routine checks to see if the left-arrow key is pressed and, if so, freezes the game and waits until it is pressed again.

The third routine uses a counter and a pointer to a note in a list. The list of notes is held in the 0.5K of unused colour nybbles from locations 37888 to 38399. Since only the first four bits of each byte actually exist, each note has to be stored in two parts.

The first four bits of each note are held in a list starting at 37888. The second four bits are held in a list starting at 38144. The final notes of each list must be a zero for the machine code to replay the tone.

You may like to try your hand at changing the tune, but it is no mean task. The following four-line Basic program can be used to Poke the new notes into your memory. You input the notes in the normal way and the computer does all the work. The delay for each notes if the same each time using the tune interrupt with the game;

```
1 FOR I = 0 to 99 : INPUT N : If N = -1 THEN
  END
2 Q = (N AND 240)/16 : POKE 37888 + I , Q
3 POKE 38144 + I , N - Q * 16
4 NEXT I
```

This program should be typed in after loading part three. To do this you must delete the last two lines of program 2 which automatically loads part three. Run the program then New it and load part three. There should be enough memory left to add the four lines. However, this is only optional, you do not have to change the tune. End the Data with two zeros.

Program 1. The title program.

```
5 REM FOR "[illegible]" READ INVERSE POUND SIGN
6 REM CTRL + KEY 3
10 POKE36879,8:PRINT"[illegible]"CHR$(8):POKE55,0:POKE56,28:CLR
20 PRINT"[illegible]":PRINT"[illegible]":PRINT"[illegible]"
40 PRINT"[illegible]"
70 PRINT"[illegible]COPYRIGHT 1983"
80 PRINT"[illegible]M.DCNAGHY [illegible] D.MC.COMB"
90 PRINT"[illegible] HIT A KEY ";:POKE198,0:WAIT198,1:PRINT"[illegible]"
1000 REM LOADER FOR NEXT PROGRAM
1010 POKE198,7:POKE631,76:POKE632,207:POKE633,159:POKE634,13
1020 POKE635,82:POKE636,213:POKE637,13
```



The Legend cont
Since before the mists of time, legends have been born out of conflict; not least the conflict of the mind over seemingly overwhelming odds.
Now the Imagine legend continues, with a new generation of games. Do you possess the determination to pit your mind against, and eventually conquer this new breed?
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and all other good
Software Outlets.
Zzoom – As you climb into your gleaming Grou
Skimmer and slide behind the highly sophistica
Flight computer, the feeling of excitement turn
dread. Another mission is about to begin. Conc
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air, air-to-sea missiles you're going to need the
defend yourself against the endless variety of a
weapons the enemy will unleash on you includi
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And yet, with all these advanced features, the Spark-Jet costs only £365.



THE ACORN SPARK-JET PRINTER

Not only that, but you also receive a free program on cassette that enables you to 'dump' graphics from either monitor or TV.

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32 Princes Street, Ipswich, Suffolk IP1 1QG.
0473 59181.
MICROSTYLE
47 Cheap Street, Newbury, Berkshire. 0635 41929.
COMPUTERS FOR ALL
72 North Street, Romford, Essex. 0708 60725.
JESSOP MICROELECTRONICS LIMITED
Unit 5, 7 Long Street, London E2 8HN.
01-739 3232/729 1851.
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26 Tottenham Court Road, London W1. 01-580 1328.
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01-574 5271.
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208 Maybank Road, South Woodford, London E18.
01-505 7724.
LEASALINK VIEWDATA LIMITED
Scientific House, Bridge Street, Sandiacre, Nottingham NG10 5BA. 0602 399484/396976.
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46 Charles Street, Cardiff, Glamorgan.
0222 373072.
LEAMINGTON HOBBY CENTRE
121 Regent Street, Leamington Spa, Warwickshire.
0926 29211.
RDS ELECTRICAL
157/161 Kingston Road, Portsmouth, Hampshire.
0705 812478.
TWICKENHAM COMPUTER CENTRE
72 Heath Road, Twickenham, Middlesex.
01-891 1612.
KELLY'S COMPUTER MARKET
227 Dartmouth Road, Sydenham, London SE26 4QY.
01-699 6202/4399.



(continued from page 94)

```
 2040 O=0:POKE1,0:POKEV-E,0:IFL=0THEN3500
 2050 FORT=8151TO8167:POKET,36:NEXT:POKET,37:A4=8168:FORT=0TO999:NEXT:B1=0:GOTO7
000
 2090 FORT=8151TO8167:POKET,36:NEXT:POKET,37:FORT=0TO2000:NEXT:GOTO8000
 3000 IFS>=BTHENB=S
 3010 PRINT"▀▙"TAB(26-LEN(STR$(B)))RIGHT$(STR$(B),LEN(STR$(B))-1);:RETURN
 3500 FORT=0TO999:NEXT:PRINT"▒"TAB(136)"▒╭────────────╮▒"TAB(162)"|▒?▒ GAME O
VER ?▌
 3510 PRINT"▒▒"TAB(188)"╰────────────╯":POKEV,15:POKEV-3,0:POKEV-4,0:RESTORE:FO
RT=0TO7
 3520 READC,D:POKEV-2,C:FORU=0TO50*D:NEXT:POKEV-2,0:NEXT:GOTO9000
 3530 DATA225,4,215,2,215,2,219,4,215,8,223,4,225,4,0,50
 5000 PRINT"▒"TAB(163)"▒▒CITY CRUSHED!":POKEM+30723,3:POKE0,0:POKE36874,0:POKE36
875,0
 5010 A8=E:FORT=0TO9:POKEM+3,33:FORU=0TO99:NEXT:POKEM+3,34:FORU=0TO99:NEXT:NEXT:
A7=0
 5020 POKE36876,240:GOSUB1500:GOSUB50:POKE36876,0:S=S+2:IFA7=0THEN5020
 5030 A6=0:A8=0:FORT=0TO999:NEXT:GOTO2090
 7000 D1=0:M=7732:POKEV,15:POKE0,1:POKE250,0:POKEX,6
 7010 GOSUB1000:GOSUB100:GOSUB100:FORT=0TO30:NEXT:IFA6=1THEN5000
 7020 IFB1=1ORD1=1THEN2000
 7030 GOTO7010
 8000 A4=8168:POKE0,0:W=W+1:SYS319:POKEV,0:POKEY,65:POKEZ,65:IFW>5THENW=5
 8010 FORT=ATOA+21:IFRND(1)<.4-(G/30)-W/100THENNEXT:GOTO7000
 8020 R1=RND(1)*7+1:R2=RND(1)*6+1+(G/2)+(W/3):R3=RND(1)*4:R4=RND(1)*5+4
 8030 FORU=TTOT-D*R2STEP-D:POKEC+U,R1:POKEU,R3:NEXT:POKEC+U,R1:POKEU,R4:NEXT:GOT
O7000
 9000 PRINT"J";:POKE38414,3:POKE7694,48+G:PRINT"▒QR:▙000000  ▒-.▙▌  ▒ST:▙000000
";
 9010 FORT=0TO25:PRINT"▒▒▀";:NEXT:GOSUB3000:FORT=0TO17:PRINT:NEXT:PRINT"▒▌";:FO
RT=0TO25
 9020 PRINT"▒J";:NEXT:PRINT"▒WX▙#$$$$$$$$$$$$$$$$$$$%▒ ▒K←←";
 9030 PRINT"▒"TAB(85)"▒▒CITY  CRUSHER"TAB(71)"▒▒────────────"TAB(57)"▒/▒ ▒= ▒S
TART"
 9040 PRINTTAB(45)"▒▒;<=▒ ▒=▒ LEVEL SELECT"TAB(81)"▒>▒ ▒= ▒PAUSE"
 9050 V=36878:Y=374:Z=385:X=398:D=26:A=8098:C=30720:POKE650,1:E=1:F=4:H=C+1:I=32
 9060 K=203:J=64:P=3:Q=9:A2=10:A3=9000:S=0:C1=0
 9100 POKE249,1:POKE250,0:POKE0,1:POKE1,0:POKEV,15:POKEY,0:POKEZ,0:POKEX,7:SYS67
3
 9110 IFPEEK(K)=JTHENPOKE7694,G+48:GOTO9110
 9120 IFPEEK(K)=39THENL=3:GOTO8000
 9130 IFPEEK(K)=ITHENG=G+E:IFG=10THENG=E
 9140 FORT=0TO99:NEXT:POKE7694,G+48:GOTO9110
 10000 G=1:POKE36866,154:POKE36864,9:POKE36867,38:POKE36869,255:POKE36879,8:GOTO
9000
 20000 FORT=0TO13:RETURN
```

■

Defend yourself against all the horrors of an English country garden in David Whitehead's game.

THIS ARCADE-STYLE action game takes noisy advantage of the Oric's sound and graphics. It is slightly like the game Centipede as you are in the garden being attacked by all manner of creepy-crawlies.

You are armed with only a weedy weed gun against the terrors of fleas, mushrooms, homing missiles, stampers, centepods and rocks.

After the opening serenade of *Greensleeves* the screen is set up. Your firing range is extended to the limit of the red half of the background. Your score is on the top line to the left of that classic line from *The Young Ones*. When the program is run you are asked which keys you would like to use to play the game with. The easiest configurations of keys are the cursor keys and Z, C and M. The hazards themselves all have to be dealt with in different ways.

The listing should be entered exactly as shown, except that where a £ sign appears a # should be typed. The program is structured as follows:

2-9	Play tune
10-80	Movement routine
1000-1110	Firing routine
6000-6050	Set up borders
10000-10130	Mushrooms routine
15000-15100	Homing missiles routine
24050-25210	Stampers routine
30000-30130	Centepods routine
35000-35130	Fleas routine
40000-40480	Dead
50000-50060	Which keys to use
60000-60520	User-defined graphics

The centepod will not come all the way down to crush you and so it is harmless. If you hit the head of the centepod you score 1,000 points, if you hit the body you score 500 points.

Mushrooms appear at random, sometimes whole and sometimes in half. If you shoot a whole mushroom the top half of it will be transformed into a rock which can be very dangerous, as you will find out later. For the bottom of a mushroom you score 50 points, and for the top you score 100.

Homing missiles will follow you wherever you go. They move at variable speed, and although the slow ones seem to be easy points you will be lucky to evade the fast missiles for long. If you shoot a homing missile then it will return to the top of the screen and keep on

```
0 GOSUB 50000
1 CLS:              GOSUB 6000
2 FORX=1TO18:READ N,W
3 MUSIC1,3,N,15
4 WAIT W*20:NEXT X
5 DATA3,2,6,3,8,2,10,3,11,1,10,2,8,4
,5,2,1,3,3,1,5,2
6 DATA 6,4,3,2,3,3,2,1,3,2,5,4,2,2
7 PRINTCHR$(6):PRINTCHR$(17):EXPLODE
8 GOSUB 60000
9 INK 7:PAPER 0
10 K$=KEY$
11 PLOT 1,1,"Once in every lifetime
....."
17 SC$=STR$(SC)
18 PLOT 2,0,SC$
19 PLOT 1,11,T$
20 IF K$=L$ THEN X=X-1
30 IF K$=R$ THEN X=X+1
32 IFX>32THEN X=32
34 IF X<7 THEN X=7
40 IF K$=F$ THEN GOSUB 1000'FIRING R
OUTINE
50 IF K$=L$ THEN PLOT X+1,25," "
60 IF K$=R$ THEN PLOT X-1,25," "
70 PLOT X,25,"@"
75 IF SCRN(X,24)<>32 THEN GOTO 40000
77 GOSUB 10000
78 PLOT 1,26,"
            "
80 GOTO 10
1000 FOR D=24 TO 13STEP-1
1001 MUSIC 1,5,1,0:PLAY7,0,1,50
1003 PLOT X,D,"!"
1006 IFSCRN(X,D-1)=125THENQ=0
1008 IFSCRN(X,D-1)=125THENSC=SC+700
1009 IFSCRN(X,D-1)=94THENSC=SC-1000
1010 IF SCRN(X,D-1)=35THENSC=SC+50
1020 IF SCRN(X,D-1)=37THENSC=SC+100
1025 IFSCRN(X,D-1)=38THENSC=SC+25
1030 IFSCRN(X,D-1)=91THENSC=SC+300
1040 IFSCRN(X,D-1)=93THENSC=SC+1500
1050 IFSCRN(X,D-1)=123THENSC=SC+1000
1055 IF SCRN(X,D-1)<>32 THE~PLOTX,D-
1,"!"
1060 IFSCRN(X,D-1)<>32THEN1080
1070 PLOTX,D," "
1074 PLOT2,0,SC$
1077 NEXT D
1080 FORT=24TOD-1 STEP-1
1085 IF SCRN(X,T-1)=37THENPLOTX,T-1,
"^"
1087 IFSCRN(X,T  )=37THENRETURN
1090 PLOTX,T," "
1100 NEXTT
1105 SHOOT
1107 WAIT 10
1110 RETURN
6000 PAPER0:INK 7
6002 FORSW=1TO12:PLOT4,SW,17:NEXT SW
6010 FORSH=13TO26:PLOT4,SH,20:NEXT S
H
6020 PLOT3,25,0
6025 FORRT=1TO24
6028 GJ=INT(RND(1)*7)
6030 IF GJ=1THEN GJ=0
6032 IF GJ=4THEN GJ=7
6034 IF GJ=5THEN GJ=2
6037 PLOT3,RT,GJ
6038 NEXT RT
6050 RETURN
10000 K$=KEY$
10005 PLOT 1,1,"Once in every lifeti
me....."
10010 PLOT 1,26,"
                "
10020 IF K$=L$ THEN X=X-1
10030 IF K$=R$ THEN X=X+1
10040 IF K$=F$ THEN GOSUB 1000
10042 IF X<7 THEN X=7
10043 IF X>32 THEN X=32
10050 IF K$=L$ THEN PLOT X+1,25," "
10060 IF K$=R$ THEN PLOT X-1,25," "
10070 PLOT X,25,"@"
10075 MUSIC 1,6,12,1
10080 IF SCRN(X,24)<>32 THEN 40000
10090 B=INT(RND(1)*30)+7
10092 C=INT(RND(1)*23)+1
10100 IF B=15 THEN GOSUB 30000
10105 IF B=17 THEN GOSUB 35000
10106 U=INT(RND(1)*27)+5
10107 IF B=18 THEN GOSUB 25000
10108 IFB=20THEN GOSUB 15000
10110 PLOT B,C              ,"£"
10120 PLOT B,C-1,"%"
10125 PLOT X,25,"@"
10127 K=INT(RND(1)*20)+7
10130 RETURN
15000 FORQ=0 TO 26 STEP INT(RND(1)*5
)+1
15002 MUSIC1,0,1,0:MUSIC2,1,1,0:MUSI
C3,2,1,0:PLAY7,0,5,100
15005 PLOT 1,1,"Once in every lifeti
me......"
15010 K$=KEY$
15015 SE=INT(RND(1)*100):IF SE<10 AN
D SE>5THENRETURN
15020 IFK$=L$THENX=X-1
15030 IFK$=R$THENX=X+1
15032 IFX<7THENX=7
15034 IFX>32THENX=32
15040 IFK$=L$THENPLOTX+1,25," "
15050 IFK$=R$THENPLOTX-1,25," "
15060 PLOTX,Q,")"
15070 IFK$=F$THENGOSUB1000
15080 IFSCRN(X,24)<>32THEN40000
15090 PLOTX,Q," "
15092 PLOTX,25,"@"
15093 PLOT 2,0,SC$
15095 NEXT Q
15097 PLOT 2,0,SC$
15100 RETURN
24050 U=INT(RND(1)*27)+5
25000 FOR D=4 TO 26 STEPINT(RND(1)*2
)+1
25003 MUSIC1,5,(D/2)-1,0:MUSIC2,6,(D
/2)-1,0:MUSIC3,7,(D/2)-1,0:PLAY
7,2,3,100
25005 K$=KEY$
25007 PLOT 1,1,"Once in every lifeti
me......"
25010 IF K$=L$ THEN X=X-1
25020 IF K$=R$ THEN X=X+1
25030 IF X<7 THEN X=7
25040 IF X>32 THEN X=32
25050 IF K$=L$ THEN PLOT X+1,25," "
25060 IF K$=R$ THEN PLOT X-1,25," "
25076 PLOT 2,0,SC$
25080 PLOTU ,D,"("
25085 IF SCRN(X,24)<>32 THEN 40000
25087 IF K$=F$ THEN GOSUB 1000
25090 PLOTU ,D  ," "
25110 PLOT X,25,"@"
25200 NEXT D
25205 PLOT 1,26,"
                "
25206 FORUI=0TO26:PLOTU,UI," ":NEXT
UI
25210 RETURN
30000 FOR G=2 TO 23 STEP 2
30001 NJ=INT(RND(1)*27)+9:PLOTNJ,G-2
,"*":PLOTNJ+3,G+2,"*":PLOTNJ-3,
G+2,"*"
30002 PLOT INT(RND(1)*30)+7,INT(RND(
1)*25)-1,"%"
30005 FOR H=1OTO 31
30005 PLOT INT(RND(1)*30)+7,INT(RND(
1)*24)-1,"£"
30007 K$=KEY$
30008 SC$=STR$(SC)
30009 PLOT 2,0,SC$
30010 IF K$=L$ THEN X=X-1
30020 IF K$=R$ THEN X=X+1
30030 IF K$=F$ THEN GOSUB 1000
30040 IF X<7 THEN X=7
30050 IF X>32 THEN X=32
30060 IF SCRN(X,24)<>32 THEN 40000
30070 IF K$=L$ THEN PLOT X+1,25," "
30075 IF K$=R$ THEN PLOT X-1,25," "
30076 MUSIC 1,1,G/2,0:MUSIC 2,3,G/2,
0:PLAY 7,0,1,400
30079 PLOT 1,1,"Once in every lifeti
me......"
30085 PLOT X,25,"@"
30090 PLOT H,G,"]"
30100 PLOT H-1,G,"["
30105 PLOT H-1,G-2," "
30107 PLOT H+1,G-2," "
30108 U=INT(RND(1)*20)+7:IFU=15THEN
GOSUB 24050
30109 IFU=16THENGOSUB15000
30110 NEXT H
30120 NEXT G
30125 PLOT 5,22,"
          "
30130 RETURN
35000 PLOT 28,0,"Flea storm!"
35001 MUSIC1,7,3,0:PLAY7,0,1,2000
35002 FOR V=1 TO 26
35005 K=INT(RND(1)*20)+7
35010 K$=KEY$
35015 PLOT 1,1,"Once in every lifeti
me......."
35020 IF K$=L$ THEN X=X-1
35030 IF K$=R$ THEN X=X+1
35040 IF K$=F$ THEN GOSUB 1000
35050 IF X<7 THEN X=7
35060 IF X>32 THEN X=32
35070 IF K$=R$ THEN PLOT X-1,25," "
35080 IF K$=L$ THEN PLOT X+1,25," "
35090 PLOT X,25,"@"
35100 PLOT K,V,"&"
35105 PLOT K,V-1," "
35110 SC$=STR$(SC)
35120 PLOT 2,0,SC$
35125 NEXT V
35127 PLOT 27,0,"             "
35130 RETURN
40000 PLOT X,25,"]"
40030 EXPLODE:PLAY 7,7,1,65000
40040 WAIT 700
40050 CLS:INK0:PAPER7
40060 PRINT:PRINT"Your score was "SC
$""
40080 PRINT:PRINT:PRINT"Would you li
ke to play again"
40085 GET C$
40090 GET B$
40095 PRINTCHR$(6):PRINTCHR$(17)
40100 IF B$="Y" THEN RUN
40110 END
40480 RETURN
50000 CLS
50005 PING
50008 PRINT:PRINT"Which key would yo
u like to use"
```



coming until it runs out of fuel. Homing missiles are worth 1,000 points each time you shoot them.

Stampers cannot be stopped but they can harvest a lot of points. They come down very fast and make a terrible racket. They are worth 1,000 points every time you hit them.

Fleas occur in storms and they are the worst pests of the garden. They are worth only 25 points and they come down in tens. Rocks, as previously mentioned, appear when you shoot a full mushroom. They do nothing but if you shoot a rock then you lose 1,000 points.

My own high-score is 65,000, which I am sure most of you will beat. Happy shooting.

```
50010 PRINT:PRINT"a.To move left ?":
GET L$
50020 PRINT"b.To move right ?":GETR$
50030 PRINT"c.To fire ?":GET F$
50040 PRINT:PRINT   "Thank you"
50050 WAIT 200
50060 RETURN
60000 FOR Y1=46376 TO 46383
60010 READ Y2:POKE Y1,Y2
60020 DATA 0,30,53,45,53,53,43,33
60030 NEXT Y1
60040 FOR Y3=46360 TO 46367
60050 READ Y4:POKE Y3,Y4
60060 DATA 51,18,22,18,22,26,18,33
60070 NEXT Y3
60080 FOR Y5=46592 TO 46599
60090 READ Y6:POKE Y5,Y6
60100 DATA 12,12,30,63,63,63,30,30
60110 NEXT Y5
60120 FOR Y6=46808 TO 46815
60130 READ Y7:POKE Y6,Y7
60140 DATA 30,63,63,63,63,63,63,30
60^50 NEXT Y6
60170 FOR Y8=46824 TO 46831
60180 READ Y9:POKE Y8,Y9
60190 DATA 1,61,54,60,54,61,1,0
60200 NEXT Y8
60210 FOR Z1=46832 TO 46839
60220 READZ2
60230 POKE Z1,Z2
60240 DATA 4,30,63,62,62,62,24,8
60250 NEXT Z1
60260 FOR Z3=46416 TO 46423
60270 READ Z4
60280 POKE Z3,Z4
60290 DATA 33,51,12,12,30,45,33,0
60300 NEXT Z3
60310 FOR Z5=46384 TO 46391
60320 READ Z6:POKE Z5,Z6
60330 DATA 8,42,62,62,62,62,42,0
60340 NEXT Z5
60360 FOR Z7=47064 TO 47071
60370 READ Z8:POKE Z7,Z8
60380 DATA 18,33,33,18,12,63,45,63
60390 NEXT Z7
60400 FORZ9=47080TO47087
60410 READA1:POKEZ9,A1
60420 DATA0,0,12,30,63,63,30,12
60430 NEXT Z9
60440 FOR B6=47072 TO 47079
 60450 READ B7:POKE B6,B7
60460 DATA 12,30,63,12,12,12,30,12
60470 NEXT B6
60480 FOR B8=46344 TO 46351
60490 READ B9:POKE B8,B9
60500 DATA 33,18,12,29,46,12,18,33
60510 NEXT B8
60520 RETURN
```

Let battle

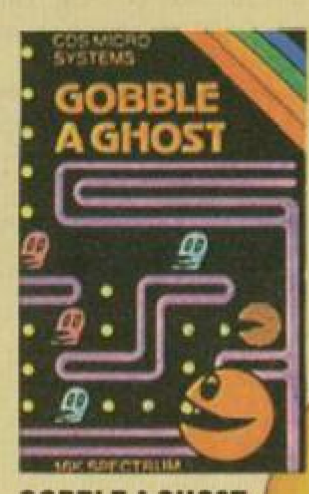
BUT BEWARE-ATTACK

Want a *real* fight on your hands?

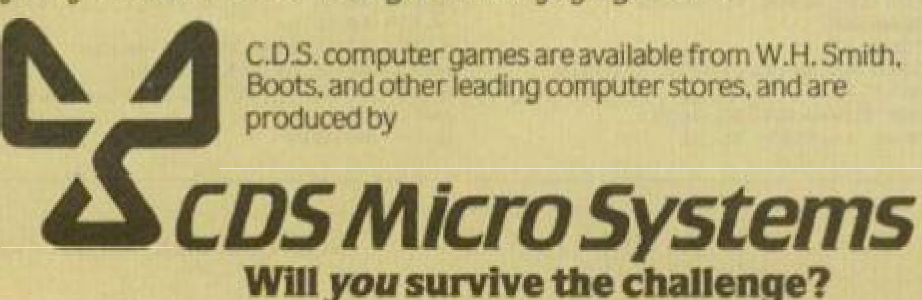
Then go for CDS, the games packed with excitement, challenge and the thrill of the unexpected.

Fight your way across a five lane highway with the frantic frog . . . eat a path through the fiercesome fighting ghosts . . . face the huge ferocious caterpillar in the mushroom field . . . protect the panicky painter as he flees from danger . . . outwit and confuse your opponent with a counter attack on the board.

Yes, with CDS games you get it all.
And they only cost £5.95 each. Go get 'em boy, go get 'em!



GOBBLE A GHOST
Moving around and gobbling up dots sounds easy. But not when 4 ghosts are constantly trying to destroy you. Kill or be killed – the 4 power pills are your answer. It's all a question of who gets who first . . .



C.D.S. computer games are available from W.H. Smith, Boots, and other leading computer stores, and are produced by


commence
IS YOUR ONLY DEFENCE!
5 PATHS TO EXCITEMENT ON THE 16K SPECTRUM!
CDS MICRO SYSTEMS
CATERPILLAR
16K SPECTRUM
LEAPFROG
CDS Micro Systems
3D PAINTER
16K SPECTRUM
CDS Micro Systems
BOZY BOA
?
CATERPILLAR
The giant caterpillar is coming to get you, helped by a horde of weird creatures. Destroy it segment by segment, blast a way through the mushrooms, kill off the ugly creatures. But don't relax... there's danger everywhere!
LEAP FROG
A frog meets many dangers on his way home. Like 4 lanes of fast moving traffic, a swirling log-filled river, plus diving turtles, frog-eating snakes and nasty alligators. Do you have the skills to see him home safely?
PAINTER
The bonus score is ticking away as you help the panicky painter paint the 3-D maze. Can you finish before it hits zero? Will the computer outwit you? And look out – the game goes faster as you get better!
BOZY BOA
It's a hectic life being a boa in an English country garden. There are juicy beetles if you can find them, and snails too if you are lucky. First left, then right and inbetween the flowers – you've got to be quick! After a couple of games you'll be as boss-eyed as me!
and we'll keep on coming to get you!

CASSETTE FILES

ZX-81

At last the ZX-81 has agreed to handle cassette data files, persuaded by Kevin Hill's program.

FED UP with writing machine code because of the complexity of saving and loading it? Or do you write programs needing various data to be stored on tape? This program can save any block of the computer's memory onto tape, verify it, distinguish it from a normal Basic program and load it back into the same, or a different, part of the memory.

The first thing to do in order to type it in is to lower RAMtop to some value lower than 31681. The easiest way to do this is as follows:

```
POKE 16388, 193
POKE 16389, 123
NEW
```

Now type in the loading program in figure 4. This is a modified menu-driven version of the standard hexadecimal code loader, designed so that the machine code does not all need to be typed in at one go. If the first character of a byte is not a hexadecimal character, you will be returned to the menu where the options are self-explanatory.

There are five anomalies in the hex listing of the program which now need correecting. These concern the error-code messages. Error, codes greater than 127 do not actually stop a program when it is running.

Address	Old value	Corrected value
32076	9D	1D
32144	9B	1B
32184	8B	15
32246	96	16
32293	8C	11

Once you have a copy or two of the program on tape, you can resave the machine code using the program in figure 5 as this will load in quicker. Simply lower RAMtop as before, load in the machine code and loader program from tape, allow the machine code to be Poked in and stop the program. New it, type in the program in figure 5 and then Run it.

Having typed in all the machine code and checked that it is correct, how do you use the program?

The program is called by Rand USR 32067 whether you are Saving, Verifying or Loading. A Basic variable — U$ — is used to tell the program what to do; its syntax is shown in figure 1 along with some examples. Do not insert any spaces before the command as this will cause an error. The only character that can precede the command is an asterisk which prevents any messages being printed on the screen. For this reason, the asterisk should not be used with Verify.

Only the first letter of the command is considered, to Save, S and Sausages all mean the same thing. The three commands that can be used begin with S, L or V for Save, Load and Verify respectively. A pair of brackets must follow the command and contains the name of the data file.

All the characters between the brackets including spaces are used for the name. If there are no characters between the brackets, this is the same as the Basic Load quote quote; that is, the next program on the tape regardless of name will be loaded or verified depending on the command.

Two parameters follow the name and I have called these Start and Length for simplicity.

(continued on next page)

Hex dump of the data-file program.

```
31681:  CD C6 7B 18 FB 0E 01 06
31689:  00 3E 7F DB FE D3 FF 1F
31697:  38 05 CD 28 0F CF 0C 17
31705:  17 38 07 10 EC F1 CD C6
31713:  7B C9 D5 1E 94 06 1A 1D
31721:  DB FE 17 CB 7B 7B 38 F5
31729:  10 F5 D1 20 04 FE 56 30
31737:  CE 3F CB 11 30 F9 C9 78
31745:  FE 00 20 02 37 C9 1A C3
31753:  3F 7D CD 00 7C D8 FE 1A
31761:  20 F8 0E 00 CD 00 7C 38
31769:  0C D6 1C 38 08 FE 0A 30
31777:  04 F5 0C 18 EF ED 53 FC
31785:  7F 78 32 FE 7F 79 FE 00
31793:  20 02 37 C9 11 01 00 21
31801:  00 00 F1 FE 00 28 04 47
31809:  19 10 FD E5 21 00 00 06
31817:  0A 19 10 FD EB E1 0D 20
31825:  E9 3A FE 7F 47 ED 5B FC
31833:  7F A7 C9 3A 39 40 FE 20
```

```
31841:  28 03 3E 76 D7 3A 3A 40
31849:  FE 02 C0 C3 0E 0C 7E CB
31857:  7F 20 04 D7 23 18 F7 E6
31865:  7F D7 C9 FD CB 21 76 C0
31873:  F5 CD 5C 7C 21 73 7F C1
31881:  C5 23 10 FD 5E 16 00 19
31889:  CD 6F 7C F1 FE 08 20 0A
31897:  CD 28 0F CD BB 02 2C 28
31905:  FA C9 FE 05 20 32 ED 4B
31913:  E0 7F FD CB 21 5E 20 04
31921:  ED 4B F4 7F CD FD 7C 3E
31929:  00 D7 3A 39 40 FE 10 20
31937:  F6 21 A4 7F CD 6F 7C ED
31945:  4B E2 7F FD CB 21 5E 20
31953:  04 ED 4B F6 7F C3 FD 7C
31961:  FE 04 20 06 21 E4 7F C3
31969:  6F 7C FD CB 21 46 C8 FE
31977:  03 20 0C 21 93 7F CD 6F
31985:  7C 2A DE 7F C3 6F 7C FE
31993:  01 28 F6 C9 C5 C5 C5 C5
```

```
32001:  E1 01 10 27 3E FF A7 3C
32009:  ED 42 30 FB FE 00 20 05
32017:  D7 E1 C3 AB 0A C6 1C 09
32025:  C1 E5 D7 E1 1E 1C C3 AD
32033:  0A 23 ED 5B FA 7F 1B ED
32041:  53 FA 7F 7A B3 C9 CD 28
32049:  0F 21 00 00 E5 E5 D1 C1
32057:  ED B0 CD 20 0F C9 05 13
32065:  A7 C9 2A 10 40 7E FE 80
32073:  20 02 CF 9D FE 5A 26 33
32081:  E6 E0 FE 80 28 08 FE C0
32089:  28 04 FE 40 20 08 23 5E
32097:  23 56 23 19 18 DF FE 60
32105:  20 05 11 06 00 18 07 FE
32113:  E0 20 06 11 12 00 19 18
32121:  EB 23 7E E6 C0 FE 80 20
32129:  F8 18 E7 23 46 23 4E 23
32137:  EB 79 FE 00 28 02 CF 9B
32145:  21 21 40 36 00 CD 00 7C
32153:  38 1B FE 17 20 04 CB F6
```

```
32161:  18 F3 FE 38 20 04 CB DE
32169:  18 10 FE 31 20 04 CB E6
32177:  18 08 FE 3B 28 02 CF 8B
32185:  CB EE CD 00 7C 30 02 CF
32193:  73 FE 10 20 F5 ED 53 DE
32201:  7F 1A FE 11 28 2C CD 00
32209:  7C 30 02 CF 74 1B E6 7F
32217:  12 13 FE 11 20 F0 D5 1B
32225:  1B 1A F6 80 12 13 EB ED
32233:  5B DE 7F A7 ED 52 7D D1
32241:  FE 11 38 02 CF 96 FD CB
32249:  21 C6 CD 0B 7C 38 15 22
32257:  E0 7F FD CB 21 CE 1B 04
32265:  CD 0B 7C 38 07 22 E2 7F
32273:  FD CB 21 D6 FD CB 21 5E
32281:  28 74 3A 21 40 E6 07 FE
32289:  07 28 02 CF 8C 3E 01 32
32297:  FF 7F 21 E0 7F 22 F8 7F
32305:  21 04 00 22 FA 7F 3E 01
32313:  CD 7C 7C CD 2F 7D CD 5B
```

(listing continued on next page)

(listing continued from previous page)

```
32321:  7E 3E 02 32 FF 7F 2A E0
32329:  7F 22 F8 7F 2A E2 7F 22
32337:  FA 7F 3E 05 CD 7C 7C CD
32345:  2F 7D 11 CB 12 CD 43 0F
32353:  38 02 CF 0C 10 FE 1B 7A
32361:  B3 20 F2 2A DE 7F CD 1E
32369:  03 CB 7E 23 28 F8 ED 5B
32377:  FF 7F CD 1F 03 2A F8 7F
32385:  CD 1E 03 CD 22 7D 20 F8
32393:  3E 02 CD 7C 7C C9 3E 03
32401:  CD 7C 7C CD 2F 7D CD 48
32409:  7F CD C6 7B 79 FE 01 28
32417:  0C C6 09 CD 7C 7C 3E 04
32425:  CD 7C 7C 18 E6 21 F4 7F
32433:  CD C6 7B 71 23 7D FE F8
32441:  20 F6 3E 04 CD 7C 7C 3E
32449:  05 CD 7C 7C FD CB 21 46
32457:  28 11 2A DE 7F 11 E4 7F
32465:  1A BE 23 13 C2 94 7E C8
32473:  7F 28 F8 3E 06 FD CB 21
```

```
32481:  66 20 01 3C CD 7C 7C 2A
32489:  F4 7F FD CB 21 66 28 09
32497:  FD CB 21 4E 28 03 2A E0
32505:  7F E5 CD 2F 7D CD 48 7F
32513:  CD C6 7B 79 FE 02 2A 0C
32521:  C6 09 CD 7C 7C 3E 04 CD
32529:  7C 7C 18 E6 2A F6 7F 22
32537:  FA 7F E1 CD C6 7B FD CB
32545:  21 66 28 10 71 CD 22 7D
32553:  28 05 CD C6 7B 18 F5 3E
32561:  02 C3 7C 7C 79 BE 20 0A
32569:  CD 22 7D 28 F2 CD C5 7B
32577:  18 F2 3E 08 C3 7C 7C 21
32585:  10 00 22 FA 7F 21 E4 7F
32593:  CD C1 7B 71 CD 22 7D C8
32601:  79 C0 CD C6 7B 71 C3 79
32609:  C0 CD 22 7D 20 F4 25 C8
32617:  FE CD C6 7B CB 79 23 F9
32625:  C9 00 00 08 11 13 23 25
32633:  33 3A 43 4F 54 5A 33 26
```

```
32641:  3B 2E 33 2C 80 34 30 80
32649:  38 2A 26 37 28 2D 2E 33
32657:  2C 80 28 34 37 80 2B 34
32665:  3A 33 29 80 38 39 26 37
32673:  39 14 80 31 2A 33 2C 39
32681:  2D 14 80 31 34 26 29 2E
32689:  33 2C 80 3B 2A 37 2E 2B
32697:  3E 2E 33 2C 80 38 2A 37
32705:  2E 28 3E 00 2A 37 37 34
32713:  37 80 27 26 38 2E 2A 80
32721:  2D 2A 26 29 2A 37 80 27
32729:  3E 39 2A 88 00 02 44 01
32737:  00 01 00 39 2A 38 B9 00
32745:  00 00 00 00 00 00 00 00
32753:  00 00 80 82 40 0A 00 E0
32761:  7F 01 00 44 46 00 01
```

```
SYNTAX FOR U$-

 COMMAND(NAME),START,LENGTH
OR
*COMMAND(NAME),START,LENGTH

SOME EXAMPLES USING A DATA FILE
CALLED PROG, 100 BYTES LONG
STARTING AT ADDRESS 16514

SAVE(PROG),16514,100
*S(PROG),16514,100
LOAD(PROG),16514
L(PROG),30720
L(),16514
L()
*L(PROG)
VERIFY()
V()
```

Figure 1.

```
SAVING PROG
OK
START=16514         LENGTH= 100
OK

SEARCHING FOR PROG
BASIC
FOUND TEST
FOUND PROG
START=16514         LENGTH= 100
LOADING
OK

SEARCHING
FOUND PROG
START=16514         LENGTH= 100
VERIFYING
VERIFY ERROR

EXAMPLES OF SCREEN MESSAGES
```

Figure 2.

```
U  U$ NOT DEFINED
S  STRING LENGTH > 255
M  MISSING COMMAND
(  LEFT BRACKET MISSING
)  RIGHT BRACKET MISSING
I  INFORMATION MISSING TO SAVE
N  NAME LENGTH > 16
```

Figure 3. Error-report codes.

```
  1 FAST
 10 LET A$=""
 20 FOR I=31681 TO 32767
 30 LET A$=A$+CHR$ PEEK I
 40 NEXT I
 50 PRINT "START TAPE AND PRESS
NEWLINE"
 60 INPUT I$
 70 SAVE "TAPE FILES"
 80 IF PEEK 16388+256*PEEK 1638
9>31681 THEN GOTO 160
 90 FOR I=31681 TO 32767
100 POKE I,CODE A$
110 LET A$=A$(2 TO )
120 NEXT I
130 PRINT "M/C LOADED"
140 PAUSE 200
150 NEW
160 PRINT "LOWER RAMTOP TO 3168
1 AND RELOAD"
```

Figure 5. Program to save machine code.

(continued from previous page)

When used, each of these parameters must be preceded by a comma and are written as decimal numbers.

Start is the start address of the block of memory where the data is to be saved from or loaded to. It is not used to Verify. When loading, Start is only needed if the data is to be loaded to a different block of memory than where it was saved from. Length is only used when saving and is the number of bytes to be saved, that is, the address of the last byte minus Start plus one.

Figure 3 shows the errors that could occur and an explanation of their meaning. Each one is printed on the screen as a normal Basic error.

Screen messages

If U$ contains no errors and the first character in U$ is not an asterisk, messages will be printed on the screen similar to those in figure 2. Each one stays on the screen for about one second before the screen goes blank to begin the cassette routines.

The messages are each printed on a new line and the screen is scrolled upwards if necessary to prevent an out of screen error 5 from occurring. If a Verify error occurs, press any key to continue.

The data files are saved in two parts. The first one is a header block which contains the name of the file and what type of file it is: 0 means Basic, 1 means header, 2 means bytes, the start location and the number of bytes of data in the next block.

When this header block is read in, the file type is checked to ensure it is a header. If it is not a header, its file type is printed on the screen, together with the name of the file; then the program searches for the next header.

When a Basic program is saved, the first byte after the name is a system variable called Versn at address 16393. Its value should be zero, but it sometimes changes. If it is not zero, strange messages could be printed on the screen as the program tries to indicate what type of file it is, or at worst, the system could crash. It is therefore safer to Poke 16393, 0 before saving a Basic program if it has a chance of being read by this program.

The second block also contains the file name and the file type which are followed by the data. If everything is all right after the second block has been saved, loaded or verified, OK is printed on the screen and the program returns in Fast mode.

Due to the size of the program a full disassembly listing has not been published, but for those of you who are interested, here are some useful addresses if you wish to disassemble it yourself.

31681 Read in byte from tape.
31744 Collect next byte from U$.
31755 Collect decimal number and put in HL.
31836 Print a new line or scroll for next message.
31855 General printing to screen.
31868 Message routine.
31997 Print decimal number.
32034 Update routine.
32047 Pause.
32067 Find U$.
32132 Analyse U$.
32277 Save.
32399 Read name from tape.
32441 Load/verify.
32628 Address table for messages.
32639 Data for messages.

Variables

16417 General control byte.
32734 Address of name.
32736 Start.
32738 Length.
32740 Name found on tape.
32756 Start found on tape.
32758 Length found on tape.
32760 Start for update.
32762 Length for update.
32764 Temporary DE register.
32766 Temporary B register.

Figure 4. The loader program.

```
  5 REM LOWER RAMTOP BEFORE
      RUNNING
 10 IF PEEK 16388+256*PEEK 1638
9>31681 THEN STOP
 15 DIM C$(1087)
 20 LET X=31681
 25 CLS
 30 SLOW
 35 PRINT TAB 14;"MENU",,,"1 EN
TER CODE",,"2 EXAMINE CODE",,"3
EDIT CODE",,"4 SAVE"
 40 PRINT ,,"NEXT ADDRESS: ";X
 45 LET I$=INKEY$
 50 IF I$<"1" OR I$>"4" THEN GO
TO 45
 55 GOTO 100*VAL I$
100 IF X=32768 THEN GOTO 25
105 FAST
110 LET A$=""
115 PRINT TAB 31;
120 SCROLL
125 PRINT X;":";
126 LET A=1
130 IF A$="" THEN INPUT A$
131 IF A$="" THEN GOTO 130
135 IF A$(1)>"F" OR A$(1)<"0" T
HEN GOTO 25
140 LET V=16*CODE A$+CODE A$(2)
-476
145 POKE X,V
150 LET C$(X-31680)=CHR$ V
155 PRINT TAB 4+A*3;A$( TO 2);
160 LET X=X+1
165 IF X=32768 THEN GOTO 25
170 LET A$=A$(3 TO )
175 LET A=A+1
180 IF A=9 THEN GOTO 115
185 GOTO 130
200 PRINT "START ADDRESS:";
205 INPUT S
210 PRINT S
215 PRINT TAB 31;
220 SCROLL
225 LET A=1
230 PRINT S;":";
235 LET V=PEEK S
240 PRINT TAB 4+A*3;CHR$ (28+IN
T (V/16));CHR$ (28+V-16*INT (V/1
6));
244 IF INKEY$="M" THEN GOTO 25
245 IF INKEY$="" THEN GOTO 250
246 INPUT A$
250 LET S=S+1
255 IF S=32768 THEN GOTO 25
260 LET A=A+1
265 IF A=9 THEN GOTO 215
270 GOTO 235
300 PRINT "ADDRESS: ";
305 INPUT S
310 PRINT S;"=";
315 LET V=PEEK S
320 PRINT CHR$ (28+INT (V/16));
CHR$ (28+V-16*INT (V/16))
325 PRINT ,,"NEW VALUE:";
330 INPUT A$
335 PRINT A$
340 LET V=16*CODE A$+CODE A$(2)
-476
345 POKE S,V
350 LET C$(S-31680)=CHR$ V
355 GOTO 25

400 PRINT "START THE TAPE AND P
RESS      NEWLINE"
405 INPUT A$
410 FAST
415 SAVE "LOADER"
420 IF PEEK 16388+256*PEEK 1638
9>31681 THEN GOTO 445
425 FOR I=1 TO 1087
430 POKE 31680+I,CODE C$(I)
435 NEXT I
440 GOTO 25
445 PRINT "LOWER RAMTOP AND REL
OAD"
```

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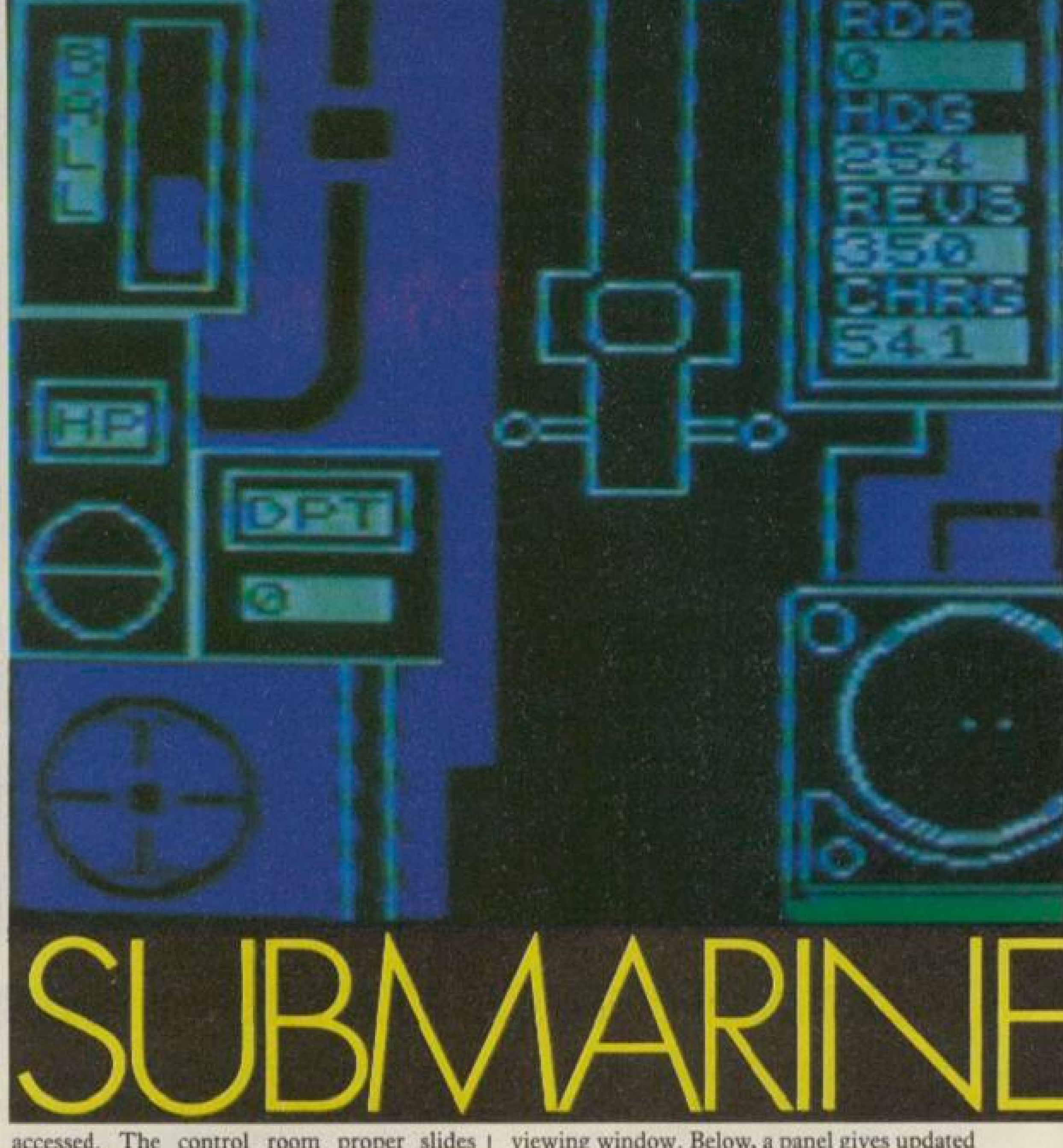
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SUBMARINE

TWO SUBMARINES seek each other's destruction in this tough and tense World War Two scenario. I certainly do not find it easy to make a kill, with all the advantage of inside information.

A Second World War S-type submarine was a fairly small craft which could manage about 16 knots on the surface and about nine knots submerged. Radar might well have been on board, certainly Asdic and echo sounder. Optimum periscope depth was about 34 feet. Surfacing and submerging was managed with the two pairs of hydroplanes and a number of ballast tanks. Hydroplanes were simply balanced horizontal rudders which used engine power to deflect the course of the submarine upwards or downwards.

There are three major displays: first, the control room; to the left of the display is the main ballast tank indicator, filled or vented to alter buoyancy. Below is a representation of the forward starboard hydroplane. Common sense will tell you which inclination will help the boat to rise. Next to the hydroplane telltale is a digital depth indicator. The large wheel to its left is one of the type which used to be needed to adjust the hydroplanes.

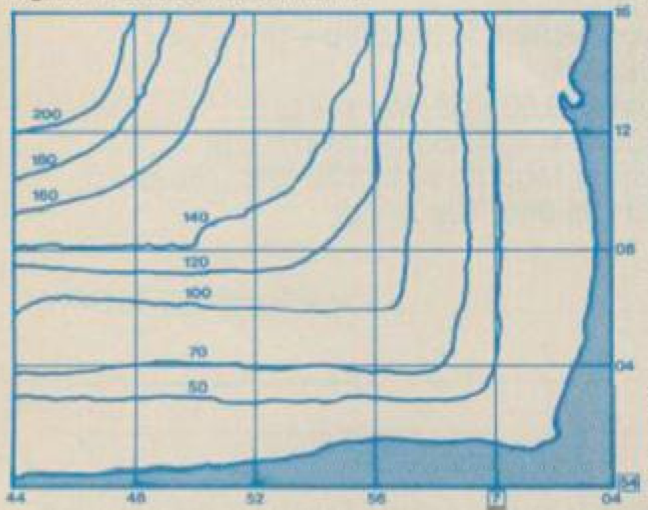
Raise periscope

In the centre, the periscope can be raised and lowered. For our purposes, it must be up in order to look through it. A panel of digital readouts displays rudder angle, heading, engine revs and battery charge in that order. The battery is automatically charged on the surface, incidentally. Care should be taken when submerged, that sufficient charge always remains to resurface.

Beside the panel, another instrument shows whether diesel or electric motors are in use, and flashes a warning if the boat begins to go under with the diesels running. The torpedo count, top right, is self-explanatory. Our Asdic set displays a North-up true bearing for targets within a four-mile range. It comes on automatically at depths greater than 10 feet. On the surface, the radar set is switched on instead. It has a greater range — 22 miles — and again is a north-up, PPI display, on which each sweep of the antennae is seen. Finally, the echo-sounder indicates the depth of water below the keel. Thus, if the boat is rising, the trace falls, as it does when the submarine remains level while the sea-bottom shelves off. It reads from 200 feet up to zero.

The second display shows the chart room: this is really part of the control room; when accessed. The control room proper slides across, making room for the chart display as it goes; this simulates the skipper walking across to the chart table. Sounder and Asdic sets both remain in view, now on the left, and both continue to work. On the chart itself, apart from local coastline, there is a large compass rose, the boundaries of a continuous coastal minefield — m — and a longitude — latitude grid calibrated at bottom and right. Inverse figures give degrees, the others, minutes.

Figure 1. Seabed contour chart.



For simplicity's sake, a minute is taken to be a nautical mile on both axes. At the top left of the chart, a short line radiating from a small circle points in the direction of the tidestream. Your own position is pointed to by a miniature submarine — at the left-hand end. Below the chart can be found tide strength, speed through the water, and the enemy's reported position at the start of the game. The enemy is always surfaced for the solo game, and always starts off from some point on the eastern side of the chart, steaming a course with a lot of west in it, at a random speed up to about four knots. Your own position is not updated while the chartroom is accessed.

The third display shows the periscope view: this shows as a framework, the brass flange surrounding the periscope viewing window. Below, a panel gives updated readings of periscope angle, heading, enemy distance and torpedo count.

Taking these in order: the periscope may be rotated full circle, and the angle indicated relates to the keel, reading 0 when the periscope is looking along the bows. Heading is simply the direction in which the vessel is pointing, and not necessarily the direction in which it is actually moving. Enemy distance is read from the radar; life would be quite difficult without it. Torpedo count keeps track of torpedoes running, since salvos may be fired. Salvos must be fired in line, spread in time, not angle. Torpedoes run at 45 knots, and have a range of three miles, being fired only through bow tubes. If the periscope angle is other than zero on firing, it will automatically swing to, and lock on zero.

Torpedoes running

The rest of the display also locks until a torpedo strikes home, or until all have run themselves out. If a miss has clearly been made, the salvo may be aborted. A bubble track gives some indication of the progress of torpedoes, though not giving any actual position for the torpedo, of course. Torpedoes cannot be fired unless the rudder is straight and the boat is maintaining a steady depth less than or equal to maximum periscope depth.



MISSION

You are on the bridge of your submarine when radar picks up an enemy U-boat recharging on the surface. Destroy it before it destroys you in Rod Hopkins' fight to the finish.

the latter ranges from zero to about 37 feet, the horizon rising up the window as the submarine sinks.

From such a low vantage point as another submarine, and in potentially hostile waters, all you can hope to spot is the conning tower of an enemy U-boat. This conning tower varies in size with distance, and moves in high resolution, flicker-free increments along the horizon according to the relative motions of the two subs. Range of vision is affected by the depth of the viewer.

A fourth display is the boot-up screen. This stems from an early idea, since abandoned, to allow the skipper to carry out a simulated sextant reading to establish his own position.

And now to business, Commander. Screen constructions: figure 3 gives three listings required to build up the major displays. The recommended procedure is as follows: in turn, type in and run each listing, saving the result as a screen$ on tape, along with the construction program itself. The latter is not needed directly, but is worthwhile saving in case of problems, or to satisfy a later craving for customising. Consult figure 2 to discover the final destination of each display. When the time comes to load them into their proper places, a command of this type:

LOAD ""CODE ADDRESS

will load any of the screen$ into the address specified, rather than into the screen RAM.

Note that, in the case of both the control room and the chartroom, the machine-code paint routine must be present in line 1 of the construction program; it could be entered separately and merged with each listing in turn. The routine is worth keeping as a utility in its own right, anyway. Referring now to the periscope print routine in the control room listing, the strings of letters A-N are all of graphic-shifted characters, of course.

Table 1. Keyboard controls.

Key	Function
5	rudder left
6	hydroplane down
7	hydroplane up
8	rudder right
A	abort salvo
B	blow ballast
C	goto Chartroom
E	electric motors on/off
F	fire second and subsequent torpedoes
I	decrease periscope angle by six degrees
J	decrease revs
K	increase revs
N	flood tanks (negative buoyancy)
O	increase periscope angle 36 degrees
P	periscope up/down
T	prime torpedo tubes and fire first torpedo
V	view through periscope
X	exit from chartroom

Machine code and tables: see figure 5. Clear 60415 before entering anything, and then use the loader routine of figure 4 to enter each block in turn. Save intermediate stages on tape and reload before starting again:

SAVE "FILENAME" 60416,5120

When this little task has been accomplished and the results saved, then, with the machine code resident in RAM, type:

CLEAR 32767

and load each of the three screen displays into their allotted spaces using the procedure outlined earlier. Save the total as:

SAVE "Uboat CODE" CODE 32768,32768

There is a 6K+ gap; it is more convenient to load the 32K block in toto. The gap is used as a dynamic store for the control room display.

Basic: figure 6 gives the main Basic program which should be saved on tape immediately following the 32K of code. Do not forget to verify at any stage at which a significant amount of labour would be wasted in the event of a saving problem. Make the Basic autorun by typing:

SAVE "UBOAT HUNT" LINE 1

Finally, concoct a short header-cum-loader program displaying your family crest or

(continued on page 111)

(continued from page 109)

whatever, making sure it ends with these lines:
200 PAPER 0: INK 7: BORDER 0: CLEAR 32767
210 LOAD "" CODE: LOAD ""

Save the loader, in autorun mode, in a space conveniently left before the 32K block of code on tape.

A small word of warning: do not try running anything without securing it on tape first. The most piffling error in a lot of the machine code could prove devastating. In the Basic program moreover, check the initialisation routine — lines 9900 onwards carefully, as in some cases even the order of assignment of variables is critical. Do not delete any variables because they apparently appear only in this routine. They are used by the machine-code routines, in all likelihood.

In a later issue I hope to publish details of program additions needed to use the program on two linked computers, and also of the modest hardware involved. The age of networking fast approaching, it would seem an obvious and exciting direction for home computing to branch into. Copies of this program are available on cassette from Protech for £5.99. Also included on the tape is the two-computer version for which you will need extra hardware. Protech is at Clydesdale Bank Buildings, South Queensferry, Scotland.

FIRE ONE

KEYING IN

- *Type in 1 REM followed by 95 characters. Follow this with lines 20 to 40 of the machine-code loader program, figure 4. Run the program and enter the 95 bytes in the Paint Routine, giving the start address as 23760. Now type in the rest of the Draw Control Room program overwriting or deleting lines 20 to 40 of the loader program.*
- *Run the program and save the display to tape, line 50. Repeat the process above with the Draw Chartroom program. Type in and run the Draw Periscope program, again saving the display to tape.*
- *Type CLEAR 60415 and then enter the machine-code loader program again. Run the loader and enter the 10 blocks of machine code in figure 5. Although it would be possible to enter and save all 10 blocks in one go it is better to save each block as it is entered. Thus to save Block 1 which contains 115 bytes type SAVE "BLOCK1" 60416,115. When all the code is in save it as one machine file by SAVE "FILENAME" 60416,5120.*
- *Reload the three screen displays at the addresses given in figure 2. For example; to load the Control Room display LOAD "" CODE 39680. Now save the screen displays and the machine code together by SAVE "Uboat CODE" 32768,32768. Type in and save the Basic program in figure 6. Create the header-cum-loader program described on page 112 and save it at the front of the tape.*

```
DRAW CONTROL ROOM
   1 REM 95-BYTE PAINT ROUTINE
   2 REM  DO NOT RUN IN THE
ABSENCE OF THE PAINT ROUTINE IN
A REM STATEMENT AT LINE 1
   3 INPUT "BACKGROUND COLOUR? "
;I
   4 INPUT "SOUNDER COLOUR? ";SC
   5 POKE 23561,0: LET PAINT=238
46: LET XC=23847: LET YC=23848:
LET ATT=23850: LET BOX=9999
  10 PAPER 0: BORDER 0: INK 7: C
LS
  12 RESTORE 9956: LET A=0: LET
B=1: FOR N=1 TO 23: READ V,L,C,A
$: PRINT INVERSE V;AT L,C;A$: NE
XT N
  13 RESTORE 9965: FOR N=1 TO 12
: READ X,Y,R: CIRCLE X,Y,R: NEXT
 N
  14 RESTORE 9970: FOR N=1 TO 22
: READ A,B,X,Y: PLOT A,B: GO SUB
 BOX: NEXT N
  16 GO SUB 7000
  17 PLOT 250,44: PLOT 225,44: P
LOT 225,4: PLOT 250,4
  18 REM PLOT 203,131
  19 PLOT 79,175: DRAW 0,-145: D
RAW -8,0: DRAW 0,-29: PLOT 194,5
2: DRAW 60,0: PLOT 135,65: DRAW
50,0: DRAW 0,-15
  25 PLOT 132,4: DRAW 52,0
  30 RESTORE 9960: FOR N=1 TO 27
: READ A,B,C: POKE XC,A: POKE YC
,B: POKE ATT,C: RANDOMIZE USR PA
INT: NEXT N
  40 REM PLOT 0,175: DRAW 70,0
  49 INPUT A$
  50 SAVE "CONTROOM"SCREEN$
  98 STOP
  99
7010 FOR N=172 TO 175: PLOT 120,
N: DRAW 135,0: NEXT N
7020 PLOT 51,136: DRAW 0,-30: DR
AW -8,-6,-2: DRAW -10,0: PLOT 59
,136: DRAW 0,-36: DRAW -16,-10,-
1.3: DRAW -16,0
7040 PLOT 51,151: DRAW 0,24: PLO
T 59,151: DRAW 0,24
8860 REM [illegible]
8861 FOR n=0 TO 3: PRINT AT 17+n
,25;"      ": NEXT n
8900 PLOT 197,45: DRAW -4,-4,2
8920 DRAW 0,-35: DRAW 4,-4,2: DR
AW 53,0
8940 DRAW 4,4,2: DRAW 0,35: DRAW
 -4,4,2: DRAW -53,0
8980 PLOT 203,45: DRAW 0,3,-2: D
RAW 10,0: DRAW 0,-3,-2: PLOT 233
,45: DRAW 0,3,-2: DRAW 10,0: DRA
W 0,-3,-2: PLOT 208,45: DRAW 0,3
,-2: PLOT 238,45: DRAW 0,3,-2
9300 REM [illegible]
9301 DATA 20,24,12,0,28,20,12,0,
16,20,-11,0,16,20,-11,0,24,26,0,
12,21,26,0,12,24,16,0,-12,20,16,
0,-12
9320 RESTORE 9301: FOR n=1 TO 8:
 READ a,b,c,d: PLOT a,b: DRAW c,
d: NEXT N
9400 REM [illegible]
9440 PLOT 133,8: DRAW 54,0: DRAW
 4,4,2: DRAW 0,54: DRAW -4,4,2:
DRAW -54,0: DRAW -4,-4,2: DRAW 0
,-54: DRAW 4,-4,2
9450 PLOT 136,24: DRAW 46,0,2: D
RAW 4,0: DRAW 0,-16: DRAW -54,0:
 DRAW 0,16: DRAW 4,0
9525 PLOT 3,64: DRAW 24,0
9700 REM [illegible]
9701 DATA w,w,w,w,w,w,w,255,1,1,
1,1,1,1,1,255,w,w,w,w,w,w,w,1,
1,1,1,1,1,1,1,0,0,255,0,0,255,0,
0,0,28,34,65,65,66,60,0,0,60,66,
130,130,130,70,56,255,w,w,w,w,
w,w
9710 DATA 255,1,1,1,1,1,1,1,0,0,
63,64,w,w,w,w,0,0,252,2,1,1,1,1,
w,w,w,w,64,63,0,0,1,1,1,1,2,252,
0,0
9719 REM [illegible]
9720 LET w=128: RESTORE 9700: FO
R n=0 TO 12: FOR i=0 TO 7: READ
a: POKE USR CHR$ (144+n)+i,a: NE
XT i: NEXT n
9730 PRINT AT 3,6;"JK";AT 4,6;"L
M";AT 0,11;"AJKB"
9732 FOR n=1 TO 16: PRINT AT n,1
2;"CD": NEXT n
9740 PRINT AT 17,11;"HJKI"
9745 PRINT AT 18,11;"ALMB"
9750 FOR n=19 TO 20: PRINT AT n,
12;"CD": NEXT n
9755 PRINT AT 20,10;"FECDEG"
9760 PRINT AT 21,12;"AB"
9803 REM [illegible]
9810 PLOT 170,65: DRAW 0,25: DRA
W 37,0
9815 PLOT 175,65: DRAW 0,20: DRA
W 32,0
9820 PLOT 150,65: DRAW 0,15: DRA
W 20,0: PLOT 155,65: DRAW 0,13:
DRAW 15,0
9825 PLOT 177,80: DRAW 30,0: PLO
T 177,75: DRAW 30,0
9830 PLOT 56,0: DRAW 0,47: PLOT
63,0: DRAW 0,47
9865 PRINT AT 5,3; PAPER 1;" ";A
T 6,3; PAPER 1;" "
9900 REM [illegible]
9905 PLOT 135,65: DRAW 0,23: DRA
W 15,0: DRAW 0,8
9910 PLOT 140,65: DRAW 0,16: DRA
W 15,0: DRAW 0,13
9950 RETURN
9955[illegible]22,22,20,22,22,16,22,2
2,4,22,22,5,158,37,22,156,37,21,
137,12,3,179,12,3,180,55,4,134,5
5,4,15,64,12,240,104,10
9956[illegible]6,2,17,"    ",6,4,17,"
    ",6,6,17,"    ",6,6,17,"
",A,1,17,"RDR ",A,3,17,"HDG ",A,
5,17,"REVS",A,7,17,"CHRG",A,6,23
,"DM",A,8,23,"EM",A,1,27,"TORS",
6,3,27,"14
9957[illegible],14,5,"000",0,12,5,"D
PT",0,10,1,"HP",6,13,27,"    ",6,
6,27,"ASD",6,11,27,"BRG",6,8,27,
"  ",6,2,1,"S",6,3,1,"A",6,4,1,"L
"
9958[illegible]5,10,I,45,145,I,45,15
5,I,67,145,I,67,165,I,47,120,I,6
0,86,I,40,102,I,15,16,I,15,30,I,
36,15,I,36,30,I
9961[illegible]77,50,I,2,4,I,50,20,I,
194,52,I,164,70,I,144,70,I,162,6
5,I,252,165,I,260,145,I,196,155,
I
9962[illegible]194,83,I,210,140,I,158
,2,SC,252,12,SC,194,12,SC
9969 REM [illegible]
9970[illegible],14,0,112,30,55
,0,111,X,Y,1,111,X,Y,20,116,14,4
6,128,96,46,76,A,B,47,Y,A,B,X,Y+
1,132,100,46,70
9971[illegible]176,96,31,55,197,6,53,
35,0,48,31,64,37,60,29,14,52,48,
40,39
9972[illegible]200,56,46,79,213,101,1
3,13,213,117,60,14,213,77,X,Y
9973[illegible]181,161,22,12,181,117,
X,Y,181,133,14,Y,213,157,38,Y
9998 REM [illegible]
9999 DRAW 0,Y: DRAW X,0: DRAW 0,
-Y: DRAW -X,0: RETURN
```

PAINT ROUTINE

23760	50	143	92	75	56
23765	205	241	92	75	4
23770	62	175	104	56	5
23775	205	25	93	32	241
23780	66	75	205	244	92
23785	75	5	175	104	208
23790	205	25	93	32	242
23795	201	75	197	213	205
23800	229	34	209	193	12
23805	62	255	185	56	5
23810	205	25	93	32	238
23815	75	197	213	205	229
23820	34	209	193	13	175
23825	185	200	205	25	93
23830	32	240	201	197	213
23835	205	206	34	205	213
23840	45	209	190	254	1
23845	201	17	194	12	62
23850	4	205	200	92	201
23855	00	00	00	00	00

```
DRAW CHARTROOM
   1 REM 95-BYTE PAINT ROUTINE
   5 REM  DO NOT RUN IN THE
ABSENCE OF THE PAINT ROUTINE IN
A REM STATEMENT AT LINE 1
  10 INK 0: PAPER 7: CLS
  20 INK 4
  50 PLOT 0,48: DRAW 167,0: DRAW
 0,127: DRAW -167,0: DRAW 0,-127
  51 PLOT 160,174: GO SUB 60: GO
 TO 80
  60 DRAW -6,-10,-1
  65 DRAW -4,-2,-5: DRAW 12,-70,
-.6
  70 DRAW -5,-25,1: DRAW -30,-3,
-.5
  75 DRAW -45,-5,.7: DRAW -64,-7
,-.3
  76 RETURN
  80 POKE 23847,165
  90 POKE 23848,120: POKE 23850,
60
 100 RANDOMIZE USR 23846
 110 POKE 23847,112: POKE 23848,
63: RANDOMIZE USR 23846
 120 FOR n=80 TO 175 STEP 32: FO
R k=0 TO 166 STEP 8: PLOT k,n: N
EXT k: NEXT n
 130 FOR n=1 TO 167 STEP 32: FOR
 k=48 TO 175 STEP 8: PLOT n,k: N
EXT k: NEXT n
 135 CIRCLE 64,111,25: PLOT 64,1
21: DRAW 0,20: PLOT 64,101: DRAW
 0,-20: PLOT 54,112: DRAW -20,0:
 PLOT 74,112: DRAW 20,0
 140 PRINT AT 3,8;"n";AT 12,8;"s
";AT 7,3;"e";AT 7,12;"w"
 145 PLOT 115,174: DRAW 15,-80,-
.5: DRAW -128,-15,-.5
 150 PRINT AT 1,17;"a";AT 5,18;"
a";AT 9,17;"a";AT 12,14;"a";AT 1
3,10;"a";AT 13,6;"a";AT 13,2;"a"
 170 INK 7: PAPER 4
 175 PRINT AT 16,0;"44  48  52
56  "; PAPER 0;"?"; PAPER 4;"
04"
 180 FOR n=0 TO 15: PRINT AT n,2
1;"  ": NEXT n
 190 PRINT AT 15,20; PAPER 0;"54
"; PAPER 4;AT 11,20;"04";AT 7,20
;"08";AT 3,20;"12"
 199 INK 0: PAPER 7
 210 FOR N=17 TO 21: PRINT AT N,
0; PAPER 0;"
   ": NEXT N
 220 PRINT AT 18,0;"TIDE";AT 20,
0;" LOG";AT 18,9;"LAST REPORTED"
;AT 19,9;"ENEMY POSn. "
 230 FOR n=0 TO 21: PRINT AT n,2
2; PAPER 0;" ": NEXT n
 235 CIRCLE INK 4;33,144,3
 240 PRINT OVER 1;AT 15,6; INK 4
;"Heligoland"
 255 PAPER 0: INK 7
 260 SAVE "CHARTROOM"SCREEN$

DRAW PERISCOPE VIEW
   5 PAPER 0: INK 7: BORDER 0
  10 CLS : PLOT 15,39: DRAW 217,
0: DRAW 0,121: DRAW -217,0: DRAW
 0,-121
  30 PLOT 123,39: DRAW 0,-10: PL
OT 123,160: DRAW 0,10: PLOT 15,1
01: DRAW -10,0: PLOT 232,101: DR
AW 10,0
  40 PLOT 5,39: DRAW 0,121: DRAW
 10,10,-.5: DRAW 216,0: DRAW 10,
-10,-.6: DRAW 0,-121: DRAW -10,-
10,-.5: DRAW -216,0: DRAW -10,10
,-.5
  50 DATA 10,70,2,10,132,2,238,7
0,2,238,132,2,70,34,2,170,34,2,7
0,165,2,170,165,2
  60 RESTORE 50: FOR Q=1 TO 8: R
EAD A,B,C: CIRCLE A,B,C: NEXT Q
  70 FOR Q=2 TO 18: PRINT AT Q,2
; PAPER 1;"
   ": NEXT Q
 315 LET B$="[illegible]"
 320 LET A$="SA "+B$+" HDG "+B$+
" ED "+B$+" TC "+B$(1 TO 4)
 325 PRINT AT 20,2;A$
 350 PLOT 13,6: DRAW 0,12: DRAW
220,0: DRAW 0,-12: DRAW -220,0
 355 INPUT A$
 360 SAVE "PERISVIEW"SCREEN$
```

Figure 2. RAM allocation.

23755-32767	main Basic program
32768-39679	chartroom screen$
39680-46591	control room screen$
46592-53503	periscope screen$
53504-60415	dynamo control room store
60416-65535	tables and machine code,UDG.

(continued on next page)

CLOSING

(continued from previous page)

Figure 4.

```
  20 POKE 23650,0: INPUT "[illegible] ? ";A: INPUT "Save or Enter "
; LINE A$: IF A$="E" THEN GO TO
40
  30 FOR N=A TO 1E9 STEP 5: PRIN
T N;: FOR K=0 TO 4: PRINT TAB 6+
K*5;PEEK (N+K);: NEXT K: PRINT :
 NEXT N
  35 GO TO 20
  40 FOR N=A TO 1E9 STEP 5: PRIN
T N;: FOR K=0 TO 4: INPUT "[illegible]
[illegible] ";B: POKE N+K,B: PRINT TAB
 6+K*5;B;: NEXT K: PRINT : NEXT
N
```

Figure 5.

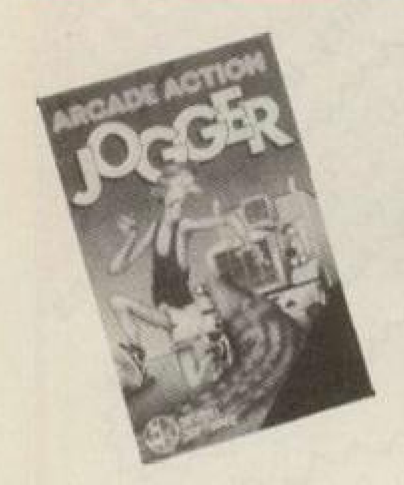
```
MACHINE CODE DUMPS
BLOCK 1
50416 0    0    0    0    0
50421 0    0    0    128  128
50426 128  128  128  128  128
50431 255  1    1    1    1
50436 1    1    1    255  128
50441 128  128  128  128  128
50446 128  128  1    1    1
50451 1    1    1    1    1
50456 0    0    255  0    0
50461 255  0    0    0    28
50466 34   65   65   66   60
50471 0    0    60   66   130
50476 130  130  70   56   255
50481 128  128  128  128  128
50486 128  128  255  1    1
50491 1    1    1    1    1
50496 0    0    63   64   128
50501 128  128  128  0    0
50506 252  2    1    1    1
50511 1    128  128  128  128
50516 64   63   0    0    1
50521 1    1    1    2    252
50526 0    0    0    0    0
BLOCK 2
50659 33   0    209  17   0
50664 64   1    0    27   237
50669 176  201  0    33   0
50674 188  17   0    64   1
50679 0    27   237  176  201
50684 17   0    209  33   0
50689 64   6    27   197  6
50694 0    78   26   119  121
50699 18   35   19   16   247
50704 193  16   241  201  201
50709 33   40   88   1    4
50714 0    229  229  17   6
50719 1    167  203  22   43
50724 29   32   250  225  25
50729 16   241  225  17   32
50734 0    25   6    8    13
50739 32   230  201  62   12
50744 58   145  92   6    7
50749 42   75   92   17   8
50754 0    25   221  33   0
50759 250  197  229  33   131
50764 92   0    2    221  126
50769 0    221  35   35   119
50774 221  126  0    221  35
50779 35   119  35   35   16
50784 238  225  6    3    126
50789 221  229  229  197  215
50794 193  225  221  225  35
50799 16   243  193  16   212
50804 178  50   145  92   201
50809 0    0    35   243  35
50814 240  35   18   35   0
50819 0    0    0    0    0
50824 0    0    0    0    0
50829 0    0    0    0    0
50834 138  27   96   34   112
50839 23   0    0    252  33
50844 51   33   0    0    0
50849 0    198  37   30   35
50854 20   35   0    0    0
50859 0    146  34   178  37
50864 52   30   0    0    0
50869 0    0    0    64   31
50874 0    0    72   38   0
50879 0    88   27   0    0
50884 0    0    75   58   58
50889 0    92   254  53   50
50894 4    254  91   56   5
50899 17   0    0    24   13
50904 214  52   135  95   22
50909 0    33   136  237  25
50914 94   35   88   42   93
50919 92   229  33   214  237
50924 34   93   92   213  205
50929 176  40   209  35   35
50934 35   115  35   114  225
50939 34   93   92   201  33
50944 65   0    17   3    0
50949 205  181  3    201  6
50954 235  33   0    1    197
50959 126  58   16   238  229
50964 205  15   238  225  35
50969 193  16   242  201  6
50974 15   197  120  58   29
50979 238  205  25   238  193
50984 16   245  201  0    0
50989 0    0    0    0    0
50994 0    0    0    0    0
50999 0    237  91   93   92
51004 213  34   93   92   253
51009 203  1    254  197  42
51014 93   92   35   34   93
51019 92   225  251  36   42
51024 93   92   35   34   93
51029 92   126  205  176  40
51034 229  235  241  43   225
51039 35   119  35   115  35
51044 114  35   113  35   112
51049 193  15   216  225  34
51054 93   92   201  0    0
BLOCK 3
51100 6    23   33   255  246
51105 205  72   230  205  216
51110 237  201  0    0    0
51115 0    0    0    0    0
51120 6    13   33   99   250
51125 205  72   230  201  0
BLOCK 4
51300 7    0    11   70   7
51305 12   1    255  10   69
51310 9    11   1    255  10
51315 68   11   9    1    255
51320 9    67   12   7    1
51325 255  9    66   13   5
51330 1    255  8    65   14
51335 2    1    255  8    64
51340 14   0    1    0    8
51345 63   14   2    1    1
51350 9    62   13   5    1
51355 1    9    61   12   7
51360 1    1    10   68   11
51365 9    1    1    18   59
51370 9    11   1    1    11
51375 58   7    12   1    1
51380 253  203  87   198  33
51385 112  239  71   17   6
51390 0    25   16   253  205
51395 218  239  253  203  87
51400 134  201  94   35   86
51405 237  83   126  92   35
51410 78   35   70   35   94
51415 35   86   35   229  245
51420 217  229  217  205  188
51425 36   217  225  217  241
51430 225  201  1    0    0
51435 58   116  239  254  13
51440 208  205  196  239  60
51445 50   116  239  205  216
51450 239  1    1    0    201
51455 1    0    0    58   116
51460 239  254  2    216  205
51465 196  239  61   50   116
51470 239  17   12   0    167
51475 237  82   205  218  239
51480 1    1    0    201  0
51485 0    0    0    0    0
51490 0    0    0    0    0
51495 0    0    0    6    241
51500 217  229  217  253  203
51505 87   198  33   158  37
51510 34   125  92   1    0
51515 22   17   0    255  205
51520 186  36   33   158  37
51525 34   125  92   1    0
51530 22   17   0    255  118
51535 118  205  186  36   253
51540 203  87   134  217  225
51545 217  201  70   237  201
51550 37   237  201  36   33
BLOCK 5
51700 17   32   0    33   225
51705 63   6    31   197  229
51710 6    192  25   126  43
51715 119  35   16   249  225
51720 35   193  16   240  201
51725 17   31   64   6    192
51730 126  18   213  17   32
51735 0    25   209  229  33
51740 32   0    25   235  225
51745 16   239  201  17   32
51750 0    33   30   64   6
51755 31   197  229  6    192
51760 126  35   119  43   25
51765 16   249  225  43   193
51770 16   240  201  17   0
51775 64   6    192  126  18
51780 213  17   32   0    25
51785 209  229  33   32   0
51790 25   235  225  16   239
51795 201  17   33   0    33
51800 1    88   6    31   197
51805 229  6    22   126  43
51810 119  25   16   250  225
51815 35   193  16   241  201
51820 17   31   0    33   30
51825 88   6    31   197  229
51830 6    22   126  35   119
51835 25   16   250  225  43
51840 193  16   241  201  213
51845 205  100  241  209  235
51850 17   31   88   6    22
51855 126  18   213  17   32
51860 0    25   209  229  33
51865 32   0    25   235  225
51870 16   239  201  213  205
51875 124  241  209  235  17
51880 0    88   6    22   126
51885 18   213  17   32   0
51890 25   209  229  33   32
51895 0    25   235  225  16
51900 239  201  6    22   33
51905 0    126  17   0    152
51910 197  213  229  205  4
51915 241  225  229  205  29
51920 241  225  209  213  229
51925 205  148  241  225  209
51930 35   19   193  16   231
51935 201  6    22   33   31
51940 209  17   21   233  197
51945 213  229  205  52   241
51950 225  229  205  77   241
51955 225  200  213  220  208
51960 177  241  225  209  43
51965 27   193  16   231  201
51970 33   0    64   17   0
51975 209  1    0    27   237
51980 176  201  0    0    0
51985 33   0    182  17   0
51990 64   1    0    27   237
51995 176  201  33   88   208
52000 17   32   0    6    15
52005 197  6    27   229  54
52010 15   35   16   251  225
52015 25   193  16   242  201
52020 33   64   0    0    0
BLOCK 6
52050 200  200  200  200  180
52055 160  160  150  150  150
52060 140  148  120  70   50
52065 50   20   10   0    0
52070 200  200  200  180  180
52075 160  150  150  150  140
52080 140  140  120  100  70
52085 50   20   20   0    0
52090 200  200  180  160  160
52095 160  150  150  145  145
52100 145  140  130  100  70
52105 50   20   20   10   0
52110 200  200  180  160  160
52115 150  150  145  145  145
52120 140  120  120  100  70
52125 50   20   20   10   0
52130 180  180  180  160  150
52135 150  145  145  145  140
52140 120  120  110  100  70
52145 50   20   20   10   0
52150 160  160  160  150  140
52155 140  140  140  140  130
52160 130  120  110  100  70
52165 50   30   20   10   0
52170 150  150  150  140  140
52175 140  140  140  130  130
52180 120  120  110  100  70
52185 50   30   20   10   0
52190 140  140  140  140  140
52195 140  130  130  120  120
52200 120  110  110  100  70
52205 50   30   20   10   0
52210 130  130  130  130  130
52215 130  120  120  120  120
52220 110  110  110  100  70
52225 50   30   20   10   0
52230 120  120  120  120  120
52235 120  110  110  110  110
52240 110  110  110  100  70
52245 50   30   20   10   0
52250 100  100  100  100  100
52255 100  100  100  100  100
52260 100  100  100  70   70
52265 50   30   20   10   0
52270 70   70   70   70   70
52275 70   70   70   70   70
52280 70   70   70   70   70
52285 50   30   20   0    0
52290 50   50   50   50   50
52295 50   50   50   50   50
52300 50   50   50   50   50
52305 50   30   0    0    0
52310 20   20   20   20   20
52315 20   20   20   20   20
52320 20   20   20   0    0
52325 0    0    0    0    0
52330 0    0    0    0    0
52335 0    0    0    0    0
52340 0    0    0    0    0
52345 0    0    0    0    0
52350 0    0    0    0    0
52355 0    0    0    0    0
52360 0    0    0    0    0
52365 0    0    0    0    0
52370 11   11   20   45   0
52375 0    0    0    0    0
52380 0    0    0    0    0
52385 0    0    0    0    0
52390 1    240  0    2    16
52395 0    4    16   4    4
52400 20   250  164  26   1
52405 84   17   0    14   176
52410 72   90   58   72   90
52415 65   58   66   67   58
52420 65   73   58   82   74
52425 58   80   80   58   80
52430 79   58   65   66   58
52435 0    0    0    0    0
52440 0    0    0    0    0
52445 0    0    0    0    0
52450 253  203  2    134  50
52455 164  243  111  58   165
52460 243  103  35   34   164
52465 243  126  230  10   60
52470 42   75   92   205  155
52475 245  25   229  43   75
52480 92   17   103  0    25
52485 235  225  6    27   126
52490 35   18   19   16   250
52495 42   93   92   229  33
52500 201  243  34   93   92
52505 205  129  245  35   35
52510 126  50   162  243  205
52515 129  245  35   35   126
52520 50   163  243  58   162
52525 243  254  0    40   30
52530 33   163  243  190  40
52535 24   71   62   24   144
52540 71   14   31   205  217
52545 13   42   75   92   17
52550 133  0    25   235  1
52555 29   0    205  60   32
52560 33   201  243  34   93
52565 92   205  129  245  205
52570 163  245  35   35   119
52575 33   202  243  17   6
52580 0    25   34   93   92
52585 205  129  245  35   35
52590 82   1    119  0    203
52595 129  245  35   35   126
52600 254  0    202  203  244
52605 205  129  245  205  142
52610 245  239  55   56   205
52615 213  45   254  0    202
52620 203  244  205  55   245
52625 205  73   245  205  129
52630 245  35   35   126  254
52635 0    40   6    205  10
52640 245  61   32   250  205
52645 27   245  205  129  245
52650 35   35   126  42   75
52655 92   17   103  0    25
52660 95   25   54   151  35
52665 54   152  50   162  243
52670 71   62   24   144  71
52675 14   31   205  217  13
52680 1    27   0    42   75
52685 92   17   103  0    25
52690 235  205  60   32   225
52695 34   93   92   201  0
52700 0    0    0    0    0
52705 0    0    0    0    0
52710 0    0    0    0    0
52715 0    0    0    0    0
52720 0    0    0    0    0
52725 0    0    0    0    0
52730 6    8    33   178  243
52735 203  46   35   203  30
52740 35   203  30   35   16
52745 245  201  33   179  243
52750 17   144  255  229  205
52755 43   245  225  35   205
52760 43   245  201  6    0
52765 126  18   35   35   35
52770 19   16   248  201  0
52775 33   200  255  6    0
52780 17   178  243  126  18
52785 19   19   18   19   35
52790 16   247  201  42   93
52795 92   229  33   220  243
52800 34   93   92   205  129
52805 245  205  142  245  225
52810 34   93   92   239  39
52815 56   205  213  45   33
52820 136  255  254  0    40
52825 9    17   8    0    167
52830 237  82   61   32   250
52835 17   179  243  6    8
52840 126  35   18   19   19
52845 19   16   240  201  42
52850 93   92   35   34   93
52855 92   126  205  178  40
52860 35   201  126  35   94
52865 35   88   35   78   35
52870 78   205  178  42   201
52875 17   47   0    19   61
52880 32   252  201  58   163
52885 243  58   162  243  201
52890 0    0    0
```

(continued on page 115)


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ZEAKER Ready Assembled - £69.50
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Spectrum Interface if required £18.50
add £3 for P&P and 15% VAT
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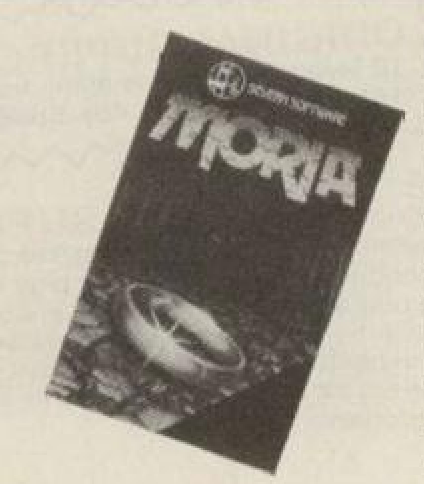


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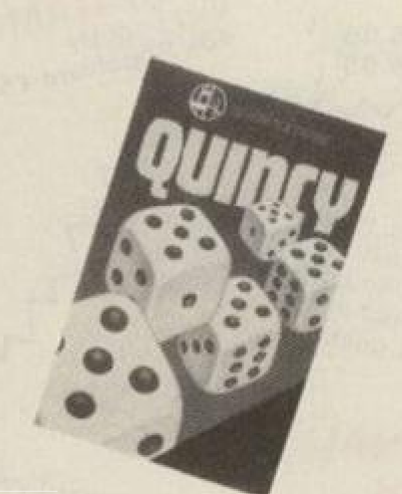
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(continued from page 112)

BLOCK 7

53232	72	65	43	40	62
53237	68	42	82	86	47
53242	49	69	52	14	0
53247	0	0	128	0	41
53252	45	67	82	42	40
53257	72	68	62	67	82
53262	41	43	67	82	42
53267	40	72	68	60	48
53272	14	0	0	0	0
53277	0	41	58	72	68
53282	58	82	86	47	61
53287	40	14	0	0	30
53292	0	0	45	69	77
53297	42	82	86	47	54
53302	54	14	0	0	66
53307	0	0	58	75	78
53312	58	66	60	64	45
53317	66	89	47	49	48
53322	14	0	0	10	0
53327	0	43	75	78	47
53332	52	48	14	0	0
53337	40	0	0	42	72
53342	80	58	60	80	64
53347	58	58	58	54	42
53352	40	68	80	64	62
53357	49	14	125	76	204
53362	204	204	41	58	68
53367	80	64	58	68	80
53372	84	62	49	48	14
53377	0	0	10	0	0
53382	58	83	85	58	84
53387	53	42	179	84	68
53392	58	64	83	67	58
53397	64	63	42	170	64
53402	56	58	84	63	63
53407	58	63	43	40	75
53412	78	42	179	72	68
53417	43	64	63	67	41
53422	47	63	70	56	63
53427	58	67	43	40	75
53432	76	42	178	72	68
53437	43	64	63	63	41
53442	47	63	70	58	67
53447	58	190	40	54	50
53452	51	64	57	14	0
53457	0	161	243	0	45
53462	106	63	42	50	48
53467	14	0	0	20	0
53472	0	43	87	41	58
53477	71	78	58	56	14
53482	0	0	8	0	0
53487	43	48	50	48	48
53492	14	0	0	200	0
53497	0	45	71	78	43
53502	68	80	64	41	47
53507	55	14	0	0	7
53512	0	0	58	80	76
53517	58	83	62	49	54
53522	14	0	0	16	0
53527	0	197	67	60	40
53532	14	0	0	0	0
53537	0	58	69	88	78
53542	58	83	60	52	14
53547	0	0	4	0	0
53552	197	67	62	49	54
53557	14	0	0	16	0
53562	0	58	69	88	83
53567	58	60	80	84	62
53572	71	78	58	66	79
53577	58	66	79	197	69
53582	66	78	197	69	68
53587	83	197	67	72	60
53592	49	14	0	0	1
53597	0	0	197	83	65
53602	198	195	69	77	58
53607	70	85	58	85	83
53612	45	83	58	83	49
53617	58	65	67	45	67
53622	55	67	49	58	187
53627	40	53	49	42	83
53632	49	43	87	49	42
53637	87	49	41	56	65
53642	66	58	182	48	63
53647	49	47	85	65	41
53652	56	64	66	62	58
53657	49	14	0	0	1
53662	0	0	45	50	14
53667	0	0	2	0	0
53672	42	40	68	80	84
53677	62	48	14	0	0

53682	0	0	0	41	58
53687	68	73	58	67	72
53692	43	68	73	42	82
53697	88	47	49	69	51
53702	14	0	0	232	3
53707	0	58	67	72	58
53712	88	83	43	40	65
53717	75	42	179	65	72
53722	43	64	83	67	41
53727	47	83	70	56	65
53732	83	58	85	87	43
53737	40	85	75	42	176
53742	85	72	43	64	83
53747	53	41	47	83	70
53752	58	85	87	58	0
BLOCK 8					
54000	81	64	16	22	145
54005	64	16	20	209	64
54010	16	16	17	72	16
54015	16	123	64	6	21
54020	197	72	28	10	187
54025	72	6	11	0	0
BLOCK 9					
54100	64	66	82	45	72
54105	65	43	67	82	42
54110	40	64	66	82	45
54115	72	65	60	48	14
54120	0	0	0	0	0
54125	41	58	69	66	58
54130	63	66	45	80	52
54135	43	67	82	42	40
54140	63	66	45	80	50
54145	68	48	14	0	0
54150	0	0	0	41	58
54155	60	67	65	58	195
54160	65	83	85	198	85
54165	60	60	64	14	0
54170	0	6	0	0	45
54175	58	80	64	47	56
54180	14	0	0	8	0
54185	0	58	85	73	58
54190	60	87	65	43	80
54195	52	58	80	67	66
54200	58	80	65	45	80
54205	52	43	67	82	42
54210	40	80	65	45	80
54215	52	60	48	14	0
54220	0	0	0	0	41
54225	58	80	87	67	58
54230	80	87	67	43	80
54235	60	58	80	67	68
54240	53	40	80	87	66
54245	45	80	87	67	41
54250	42	40	80	87	66
54255	62	80	87	67	198
54260	60	67	66	60	60
54265	57	68	41	58	62
54270	74	58	82	74	42
54275	40	82	74	200	46
54280	48	51	49	50	53
54285	14	124	0	0	0
54290	0	198	82	74	60
54295	49	46	53	53	14
54300	129	70	102	102	102
54305	41	58	82	74	58
54310	186	40	49	53	14
54315	0	0	15	0	0
54320	45	68	80	64	47
54325	51	46	54	14	130
54330	102	102	102	102	41
54335	88	72	90	65	58
54340	72	90	65	60	49
54345	64	14	0	0	16
54350	0	0	198	72	90
54355	65	62	51	14	0
54360	0	3	0	0	58
54365	60	72	58	186	40
54370	82	74	42	49	55
54375	14	0	0	17	0
54380	0	41	58	80	79
54385	58	82	74	42	49
54390	55	14	0	0	17
54395	0	0	58	80	80
54400	56	186	40	40	80
54405	80	45	80	79	41
54410	40	66	14	0	0
54415	0	0	0	41	58
54420	60	80	58	0	0
BLOCK 10					
55180	32	32	32	32	32
55185	32	32	32	33	34

DIRECT HIT

55190	32	32	38	37	35
55195	36	37	38	32	32
55200	35	36	32	32	32
55205	33	44	45	34	32
55210	32	40	42	43	41
55215	32	32	32	35	36
55220	32	32	17	156	254
55225	62	6	245	197	14
55230	23	213	205	217	13
55235	209	213	1	6	0
55240	205	60	32	209	33
55245	6	0	25	235	193
55250	4	241	61	200	24
55255	227	17	192	254	62
55260	6	245	197	14	23
55265	213	205	217	13	209
55270	213	1	6	0	205
55275	60	32	209	27	27
55280	27	27	27	27	193
55285	5	241	61	200	24
55290	226	253	203	2	134
55295	62	235	50	55	92
55300	6	3	197	205	198
55305	254	205	75	255	0
55310	193	4	120	254	13
55315	32	241	62	60	50
55320	55	92	201	253	203
55325	2	134	62	235	50
55330	56	92	6	16	197
55335	205	232	254	205	75
55340	255	0	193	5	120
55345	254	7	32	241	62
55350	60	50	55	92	201
55355	6	25	14	255	13
55360	32	253	16	249	201
55365	19	0	62	0	0
55370	0	0	0	0	24
55375	24	0	0	0	0
55380	0	28	28	28	0
55385	0	0	0	28	36
55390	36	170	0	0	0
55395	20	34	34	34	170
55400	0	0	60	66	66
55405	66	66	171	0	31
55410	33	65	65	65	65
55415	235	63	65	129	129
55420	129	129	129	235	0
55425	1	2	4	4	104
55430	64	14	0	240	16
55435	16	20	26	17	176
55440	0	0	63	64	128
55445	128	128	128	0	0
55450	252	2	1	1	1
55455	1	120	128	128	128
55460	64	63	0	0	1
55465	1	1	1	2	252
55470	0	0	0	46	52
55475	60	255	66	66	60
55480	0	0	0	0	64
55485	170	21	0	0	0
55490	0	0	0	0	223
55495	34	0	60	66	66
55500	62	74	60	0	0
55505	124	66	66	124	68
55510	66	0	0	60	64
55515	60	2	66	60	0
55520	0	254	16	16	16
55525	16	16	0	0	66
55530	66	66	66	66	60
55535	0				

Figure 6. Basic listing.

```
U-BOAT HUNT BASIC LISTING
   3 DIM S$(12,3): GO SUB VAL "9
900": GO TO VAL "1E3"
 100 REM DYNAMICS
 101 PRINT AT 0,0;: IF SU THEN B
EEP .02,44
 105 RANDOMIZE USR 61100: IF UU<
J THEN LET TBR=-TBR+CR
 110 IF CHR THEN RETURN
 130 IF NOT PV THEN GO TO 300
 140 LET S$(1)=STR$ INT (PA*DEG)
: LET S$(2)=STR$ (HD*DEG): LET S
$(3)=STR$ UD: INVERSE 1: PRINT A
T 20,5;S$(1);AT 20,13;S$(2);AT 2
0,20;S$(3): INVERSE A
 145 IF SU AND UD<E THEN BEEP .0
2,44
 150 RANDOMIZE USR 61120: IF DH
THEN GO TO 180
 160 IF DW THEN PRINT AT HZ,2;B$:
: LET DW=A
 170 RETURN
 180 PAPER 1: RANDOMIZE USR 6245
0: PAPER 0
 200 RETURN
 320 LET S$(8)=STR$ (TBR*DEG): L
ET S$(1)=STR$ INT (RD*DEG): LET
S$(2)=STR$ (HD*DEG): LET S$(3)=S
TR$ AV: LET S$(4)=STR$ CH: LET S
$(5)=STR$ TP: LET S$(6)=STR$ DPT
: LET S$(7)=STR$ (ASB*DEG)
 330 IF CHR THEN RETURN
 360 IF NOT SU THEN GO TO 400
 365 IF UD<E THEN OVER B: BEEP .
02,44: PLOT X2,Y2: LET X2=240+C*
UD*SIN TBR: LET Y2=104+C*UD*COS
TBR: PLOT X2,Y2: OVER A: LET ASB
=TBR: GO TO 420
 370 GO TO 420
 400 PLOT 158,37: IF UD<22 THEN
PLOT OVER 1;X1,Y1: LET X1=UD*SIN
 TBR+158: LET Y1=UD*COS TBR+37:
PLOT X1,Y1
 419 RANDOMIZE USR 61500
 420 RANDOMIZE USR 60709: PLOT 2
47,PL
 500 RETURN
1004 REM MAIN LOOP
1005 FOR n=A TO VAL "1E9"
1020 IF FU THEN GO TO 4000
1030 GO SUB 100
1040 IF K THEN GO SUB K: POKE 23
560,A
1050 IF PU THEN GO TO 1105
1060 IF NOT EM AND DPT THEN POKE
 22679,184: GO TO 1105
1070 POKE 22679,7
1120 NEXT n: GO TO VAL "1E3"
2000 REM HIT
2205 LET Y=167-HZ*8: LET X=RJ*14
4
2212 OVER B: FOR N=B TO C: PLOT
X+8,Y+D: DRAW -F,TN: PLOT X+8,Y+
D: DRAW A,B: PLOT X+8,Y+D: DRAW
D,F: PLOT X+8,Y+D: DRAW 22,D: PL
OT X+8,Y+D: DRAW -25,F
2214 FOR K=B TO H*TN: NEXT K: NE
XT N
2216 DATA G,250,8,16,9,16,TN,16,
12,255,13,A,H,71
2217 REM RESTORE 2216: FOR N=B T
O H: READ G,K: OUT AA,G: OUT AB,
K: NEXT N
2220 POKE VAL "60671",PEEK VAL "
60671"+B: INK C: OVER B: FOR N=B
 TO 100: PLOT X+RND*24,Y+RND*12:
 NEXT N: INK H: OVER A
2240 RANDOMIZE USR 60973: LET U$
=Z$( TO 27): FOR N=11 TO 20: PRI
NT PAPER 6;AT HZ,B+N;U$(N): PRIN
T AT HZ-B,N+B; PAPER 6;" ": FOR
K=B TO 150: NEXT K: NEXT N
2300 INPUT "'ENTER' TO CONTINUE
";A$
2305 LET PV=A: CLS : PRINT AT TN
,D;"EXCELLENT,COMMANDER!";AT 13,
D; INVERSE B; FLASH B;PEEK VAL "
60671"; INVERSE A; FLASH A;" EN
EMY DISPATCHED";AT 14,D;"PLEASE
REMAIN ON BILLET";AT 15,D;"FURTH
ER ENEMY CRAFT EXPECTED"
2310 INPUT "  'ENTER' TO RETURN
 TO DUTY";A$: IF A$<>"" THEN STO
P
2322 GO SUB VAL "9970": RANDOMIZ
E USR VAL "60689": GO SUB TN*TN:
 GO TO VAL "1E3"
3000 REM POSITION
3005 PAPER 5: CLS : FOR N=18 TO
19: PRINT AT N,9; PAPER F;"
              ": NEXT N: INK C
: PLOT 68,50: DRAW 175,A: DRAW A
,-36: DRAW -175,A: DRAW A,36: PL
OT TN,170: DRAW A,-160: DRAW 235
,A: DRAW A,160: DRAW -235,A
3008 FOR N=TN TO 160 STEP TN: PL
OT TN,N: DRAW -F,A: NEXT N: FOR
N=TN TO 240 STEP TN: PLOT N,TN:
DRAW A,-F: NEXT N: INK H: LET X=
100-U*C: LET Y=100+S: CIRCLE X,Y
,1.5
3011 PRINT AT 19-Y/8,E;"Pole Sta
r";AT 19-Y/8,21;"Pointers";AT 20
-Y/8,23;"of the";AT 21-Y/8,23;"P
lough": PLOT TN,TN: DRAW INK C;X
-20,Y-20: PLOT TN,Y: DRAW INK C;
X-20,A: RESTORE 3017: FOR N=B TO
 G: READ X,Y: PLOT X,Y: NEXT N
3017 DATA X+SQR (3600-U*U),Y+U*C
,X+SQR (100-U/E*U/E),Y+U/E,X+SQR
 (100-U/E*U/E),Y-TN,X-12,Y-12,X-
8,Y-TN,X-8,Y-TN
3060 PAPER F: PRINT AT 17,TN;"Se
xtant Lat 54 ";INT S;"'N";AT 18,
TN;"D.R.   Long 6  ";INT U+44;"'
E": PAPER A: INPUT "'ENTER' TO C
ONTINUE ";A$: RETURN
3990 REM DISASTER
4000 DIM U$(32): LET U$=Z$(B TO
32): FOR N=21 TO A STEP -B: RAND
OMIZE USR 60953: PRINT AT N,A; P
APER A; OVER 1;U$: FOR K=A TO TN
: NEXT K: NEXT N: PAPER A
4004 PRINT AT TN,F;: FLASH B
4005 IF NOT EM AND SU THEN PRINT
 "IRREPARABLY DAMAGED FROM ";AT
11,F;"RUNNING DIESELS SUBMERGED"
4010 IF SO THEN PRINT "FOUNDERED
 ON SEABED"
4015 IF EXN THEN PRINT "SHELLED
BY DESTROYER";AT 11,5;"OUTSIDE Y
OUR BILLET "
4020 IF EXS THEN PRINT "STRUCK B
Y MINE"
4025 IF CH<B THEN PRINT "BATTERY
 CHARGE TOO LOW ";AT 11,5;"TO AL
LOW RESURFACING"
4039 FLASH A
4040 INPUT "ANOTHER TRIP? (Y/N)
";A$: IF A$="Y" THEN RUN D
4100 STOP
5999 REM CHARTROOM
6000 IF PU OR CHR THEN RETURN
6001 LET SF=VAL "2100": LET X2=X
2-176: POKE 60741,201: POKE 6071
3,40: LET CHR=B: RANDOMIZE USR 6
1970: RANDOMIZE USR 61902: POKE
23560,90
6002 LET SPX=80+U*8: LET SPY=40+
S*8: IF SPX>216 OR SPX<82 OR SPY
>172 OR SPY<72 THEN GO TO 6005
6003 INK E: PLOT SPX,SPY: DRAW 8
,A: PLOT SPX+B,SPY-B: DRAW G,A:
PLOT SPX+E,SPY: DRAW A,C: INK H
6004 PRINT AT 21,19;U$
6005 INK E: PLOT 112,144: DRAW 1
```

(continued on page 117)





SINCLAIR AND ORIC COMPUTERS

Oric 1 48K computer £147 (£158). Oric 1 16K n/a (n/a). Sinclair Spectrum 48K £113 (£13). Spectrum 16K £86.91 (£107). 32K memory upgrade kit for 16K Spectrum (Issue 2 only) £26.09 (£28). Fuller master unit for the Spectrum including speech synthesizer, sound synthesizer, amplifier and joystick ports £47.78 (£56). ZX microdrive n/a (n/a). ZX rs232 n/a (n/a). Keyboards with space bars for the ZX81 and the Spectrum £36 (£41). ZX printer £34.74 (£50). 5 printer rolls £10.43 (£16). ZX81 £43.43 (£52). ZX81 16K ram packs £26.04 (£28). New luxury spectrum computers 48K with full sized typewriter keyboards complete with normal space bar enclosed in a larger plastic case which also houses the power supply and the computer pcb £138.20 (£147).



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Commodore 64 £299 (£09). Special offer package: Vic 20 + cassette recorder + basic course + 4 games £121 (£149). Convertor to allow the use of most ordinary mono cassette recorders with the Vic 20 and the Commodore 64 built £8 (£9), kit £6 (£7). Commodore cassette recorder £36.50 (£44). We stock most accessories.

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(continued from page 115)

```
5*SIN TD,15*COS TD: INK H
6006 LET Y$=STR$ TS: PRINT AT 18
,15;Y$: LET Y$=STR$ KN: PRINT AT
 20,15;Y$
6020 RANDOMIZE USR 60700: IF K T
HEN GO SUB K: POKE 23560,A: IF N
OT CHR THEN GO TO VAL "1E3"
6025 GO SUB 100: IF NOT DPT THEN
 GO TO 6027
6026 IF UD<E THEN OVER B: LET S$
(8)=STR$ (TBR*DEG): PLOT X2,Y2:
LET X2=64+C*UD*SIN TBR: LET Y2=1
04+C*UD*COS TBR: PLOT X2,Y2: OVE
R A: LET ASB=TBR: PRINT AT 13,5;
 INVERSE 1;S$(8): GO TO 6040
6027 RANDOMIZE USR 61120
6040 PLOT 71,PL: IF SU AND UD<E
THEN BEEP .02,44
6100 IF FU THEN GO TO 4000
6200 GO TO 6006
7000 IF CHR THEN RANDOMIZE USR 6
1936: LET X2=X2+176: LET CHR=A:
POKE 60741,0: LET SF=VAL "2050":
 POKE 60710,62
7005 RETURN
7050 REM [illegible]
7055 IF NOT TC THEN RETURN
7060 LET SF=VAL "2300": LET T$="
DDDDDDDDDDDDDD": LET TC=0: PRINT
 AT 20,27;"[illegible]": RETURN
7999 REM [illegible]
8000 IF NOT PU THEN RETURN
8001 IF ABS RD<1 THEN LET RD=0
8002 IF ABS HP<1 THEN LET HP=0
8005 IF DPT>37 OR RD OR BY OR HP
 THEN RETURN
8010 LET SF=VAL "1500": LET PA=A
: LET TC=A: GO SUB 8500: LET YT=
(((22-HZ)*8-40)/95)/(UD/2)
8020 FOR Q=41 TO 167-HZ*8 STEP Y
T
8025 IF FU THEN GO TO 4000
8030 PLOT INK 3;123,Q: IF INKEY$
="F" THEN GO SUB 8499
8035 IF INKEY$="A" THEN GO SUB 7
050
8100 GO SUB 100: FOR N=1 TO 14:
IF T$(N)="L" THEN GO SUB 8600
8120 NEXT N
8140 FOR N=1 TO 14: IF T$(N)="L"
 THEN GO TO 8200
8150 NEXT N
8160 LET SF=VAL "2050": RETURN
8200 NEXT Q: IF N<15 THEN GO TO
8020
8499 IF NOT TC THEN RETURN
8500 IF NOT TP THEN RETURN
8510 LET SF=SF-200: LET TP=TP-B:
 LET T(14-TP,B)=S: LET T(14-TP,C
)=U: LET T$(14-TP)="L": LET TC=T
C+B
8530 PRINT AT 20,27; INVERSE B;T
C: RETURN
8600 LET T(N,B)=T(N,B)+(50*COS H
D+TS*COS TD)/SF
8610 LET T(N,C)=T(N,C)+(50*SIN H
D+TS*SIN TD)/SF
8620 LET T(N,D)=T(N,D)+50/SF
8630 IF T(N,D)>D THEN LET T$(N)=
"D": LET TC=TC-B: PRINT AT 20,27
; INVERSE B;TC: LET SF=SF+200: R
ETURN
8640 IF ABS (T(N,B)-US)>.02 THEN
 RETURN
8650 IF ABS (T(N,C)-UU)>.02 THEN
 RETURN
8660 GO TO 8200
8699 REM [illegible]
8700 IF PU OR CHR THEN RETURN
8701 LET EM=ABS (EM-B): POKE VAL
 "22743+EM*64",VAL "56": POKE VA
L "22744+EM*64",VAL "56": POKE V
AL "22807-EM*64",H: POKE VAL "22
808-EM*64",H: RETURN
8799
8805 IF PU OR CHR THEN RETURN
8810 LET BY=BY+B*(BY<C): PRINT A
T E-BY,D;" ": RETURN
8850 IF PU OR BY<-C THEN RETURN
8855 PRINT AT E+BY,3; PAPER 1;"
": LET BY=BY-B: RETURN
8965 LET RD=RD-HPI*(RD>-H*HPI):
RETURN
8975 LET RD=RD+HPI*(RD<H*HPI): R
ETURN
8985 LET AV=RV+50*(RV<500): RETU
RN
8995 LET RV=RV-50*(RV>A): RETURN
9200 IF PU OR CHR THEN RETURN
9201 IF USR 61432 THEN LET HP=HP
-HPI
9202 RETURN
9203 IF PU OR CHR THEN RETURN
9204 IF USR 61455 THEN LET HP=HP
+HPI
9205 RETURN
9650 LET PA=PA+36*RAD: IF PA>CR
THEN LET PA=PA-CR
9655 RETURN
9670 LET PA=PA-6*RAD: IF PA<0 TH
EN LET PA=PA+CR
9675 RETURN
9701 IF PU OR CHR THEN RETUHN
9702 LET PR=ABS (PR-B): IF PR=A
THEN GO TO 9705
9703 RANDOMIZE USR 65323: RETURN

9705 RANDOMIZE USR 65291: RETURN

9800 IF PR OR CHR THEN RETURN
9810 LET PV=ABS (PV-B): RANDOMIZ
E USR 60684: RANDOMIZE USR 61997
9812 IF NOT PU THEN LET HZ=A: RE
TURN
9814 LET PV=B: RANDOMIZE USR 619
32: GO TO 100
9899 REM [illegible]
9900 LET Z$="[illegible]
[illegible]"
: DIM U$(27): POKE 60710,62: LET
 B$=CHR$ 17+CHR$ 1+"
                  ": DIM Y$(3)
9901 LET A=0: LET BY=A: LET DI=A
: LET PP=A: LET PO=A: LET CHR=A:
 LET BO=A: LET FU=A: LET K=A: LE
T TC=A: LET Z=A: LET DU=A: LET E
S=A: LET PUA=A: LET PUB=A: LET P
UC=A: LET PUD=A: LET UI=A: LET R
J=A: LET HZA=A: LET DH=A: LET KN
=A: LET SU=A: LET K=A: LET TBR=A
: LET TSS=A: LET TSC=A: LET TD=A
: LET S1=A: LET U1=A: LET UD=A
9902 LET B=VAL "1": LET C=B+B: L
ET D=C+B: LET E=C+B: LET F=E+B:
LET G=F+B: LET H=G+B: LET TN=F+F
: PAPER A: BORDER A: INK H: CLS
9903 LET PL=D+D: LET GN=VAL "180
": LET EXN=A: LET EXS=A: FOR Q=
A TO B: NEXT Q: LET RJ=A: LET HZ
=A: LET P1=PI: LET P2=PI/2
9904 DIM Q$(5): LET SY=21: LET S
X=A: LET PA=A
9906 POKE VAL "23658",H+B: LET P
R=B: LET HP=A: LET RAD=PI/VAL "1
80": LET DEG=B/RAD: LET CR=C*PI:
 LET HPI=RAD*TN
9914 RANDOMIZE : LET CO=B: LET P
V=A: LET SM=A: LET TD=RND*CR: LE
T TS=RND*F: LET CH=VAL "500"+RND
*VAL "200": LET TP=H+H: LET HD=R
ND*CR: LET RD=A: LET ASB=A
9915 POKE VAL "60741",A: POKE VA
L "60671",A: RANDOMIZE : LET S=9
*RND+F: RANDOMIZE : LET U=11*RND
+B
9920 LET DPT=A: LET BY=A: DIM T(
14,3): LET T$="DDDDDDDDDDDDDD"
9934 LET SF=VAL "2050": LET RA=V
AL "221": LET RB=VAL "223": LET
P4=PI/E: LET X=A: LET Y=22
9943 LET X2=VAL "240": LET Y2=VA
L "104": LET X1=VAL "150": LET Y
1=VAL "37": POKE VAL "61300",H:
LET RV=50*INT (RND*TN)
9955 GO SUB VAL "9970"
9956 GO SUB VAL "3000": RANDOMIZ
E USR VAL "60672"

9957 LET EM=DPT<TN: GO SUB VAL "
8700"
9958 PRINT AT A,A;
9959 RETURN
9970 RANDOMIZE : LET US=3+RND*4:
 LET UU=12+RND*4: LET UH=255+RND
*30: LET U$="S4 "+STR$ INT US+"
W6 "+STR$ INT (UL+44)+"E": LET
UH=UH*RAD: LET UK=RND*4: LET USU
=A: RETURN
```

NOTE: Z$ COMPRISES A RANDOM MIX OF UDG CHARS 'O' & 'P', FOR WHICH THE DATA IS PART OF THE FINAL MACHINE CODE BLOCK ■

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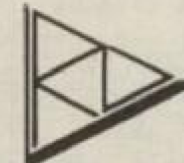
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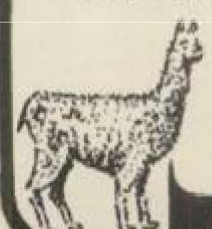
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TRADE ENQUIRIES WELCOME

Chris Davison coaxes the Spectrum's graphics out of their shells with an ingenious Basic-Logo mix.

ONE OF the most outstanding features of the ZX Spectrum is its graphics capability. Unfortunately Basic was never designed to handle graphics and, as a result of this, it is not easy to produce complex graphic displays.

Logo, on the other hand, was designed to handle graphics, and does so very well, but it is little more than a graphics language. So imagine the graphics capability of Logo combined with the mathematical and control capabilities of Basic, combine them into one language and you have Tortoise.

The idea behind turtle graphics is simple: basically, as readers of the BBC-orientated articles in *Your Computer* January 1983 will know, you are in control of a turtle.

You can instruct the turtle's movements along some surface — for example, the screen, and hence create shapes. For example, telling the turtle to:

```
Move forward one unit
Turn 90° to the left
Move forward one unit
Turn 90° to the left
Move forward one unit
Turn 90° to the left
Move forward one unit
```

would draw a square. The actual commands of the language are given later on. Obviously here we can say

```
Move forward one unit
Rotate 90° to the left
```

four times, or by using the Basic construct FOR-NEXT we can say:

```
FOR count = 1 TO 4
    (Forward one unit
    turn 90° to the left)
NEXT count
```

Having looked at turtle graphics, let us now look at Tortoise itself.

The format which Tortoise commands take is as follows. An instruction is made up of a letter followed by some parameters separated by commas. A program is made up by a number of instructions followed by an * and all separated by colons.

So the instruction to move forward five units is:

```
        F5
      /    \
LETTER    PARAMETER
```

and to move one square 50,50 we have

```
          M50,50
        /   |   \
LETTER   COMMA
 PARAMETER  PARAMETER
```

Combine these into a Program and we have

```
      F5:M50,50:*
     /   |    \    \
 INS1  INS2  COLON  *
   COLON
```

A parameter may be any of the following: a constant, a variable, an expression. Now that you know a little about the language, let us look at the program itself.

The routine at 200-330 is designed to let you play turtle before you combine Tortoise with Basic. You are limited to just one loop, yet you can produce some very exciting results. After the prompt

INSTRUCTION>"

type in your program, for example, try:

fa:r90:*

followed by Enter. The code is then displayed at the top of the screen and the prompt

Loop a start>

is given. This asks you at what value you would like the loop a to start from.

try 2

Then you are asked where you wish the count to finish,

try 50

Finally you are asked in what steps you wish the count to be incremented:

try 1

The screen clears and your program is executed. If you tried the example given, then you should see a square spiral being drawn.

When it finishes, the prompt

INSTRUCTION>

appears again and you can try something else. Note that this time your drawing will start from the last point plotted, that is, at the end of the spiral, so you may wish to move back to the centre. To do this you can use the Move command:

M128,77:*

This time type in 1 for all three loop questions; you will then be ready for your next program. The whole emphasis of this type of program is on experimentation, so do not be frightened to have a bash at something new.

Once you have used the package a few times you may wish to progress. If you delete 200-330, or type

180 GOTO 400

and start your program at 400, you can now type in your own program. Your computer will only accept Basic, so we must fool it into thinking that Tortoise is Basic. This is done by placing your Tortoise code into the string s$ and then GOSUB tort to access the main program. So your spiral program now looks like this:

```
400 LET s$ = "fa:r90:*"
410 FOR a = 2 TO 50 STEP 1
420 GOSUB tort
430 NEXT a
440 STOP
```

Do not forget to start your program with

GOSUB 9200

This sets up all the variables used.

When writing your Basic program, be careful not to use the variables used by the package — see variable list. You may use them if you wish but remember the package has its own use for them, so exercise extreme caution. Try this program:

```
LET s$ = M0,0:Ba,20,B:*"
FOR a = 0 to 2*PI STEP 0.1
    LET b = COS(a)*80 + 80
    GOSUB tort
```

TORTOIS

```
   1 REM  'Tortoise II
   3 REM A mini turtle graphics
   4 REM interpreter for the
   5 REM ZX Spectrum.
   6
   7 REM  By Chris Davison
  10 REM Normally you will put
  20 REM your own BASIC program
  30 REM here that includes the
  40 REM Tortoise II instruction
  50 REM
  60 REM The routine here at the
  70 REM moment allows you to
  80 REM use the package
  90 REM interactivly.
 100
 150 GO SUB 9200: REM Initialise
 199
 200 REM ***Interaction***
 201
 205 PRINT AT 0,10;"Code:"
 210 INPUT "Instruction>";s$
 215 PRINT TAB (10);s$(1);
 220 FOR i=2 TO 50
 230 IF s$(i)=":" THEN PRINT : P
RINT TAB (10);: GO TO 260
 240 PRINT s$(i);
 250 IF s$(i)="*" AND s$(i-1)=":
" THEN LET i=50
 260 NEXT i
 270 INPUT "Loop a start>";x1
 280 INPUT "          end>";x2
 290 INPUT "         step>";x3
 294 CLS
 295 POKE 23677,128: POKE 23678,
88
 300 FOR a=x1 TO x2 STEP x3
 310 GO SUB tort
 320 NEXT a
 330 GO TO 200
5998 STOP
5999
6000 REM **Decode Section***
6001
6010 LET v(1)=0: LET vi=2
6020 LET i=0
6030 LET i=i+1
6040 LET l$=s$(pt+i)
6050 IF (l$<>",") AND (l$<>":")
THEN GO TO 6030
6060 LET v(vi)=VAL s$(pt TO pt+i
-1)
6070 LET v(1)=v(1)+1
6080 LET pt=pt+i+1
6090 LET vi=vi+1
7000 IF l$<>":" THEN GO TO 6020
7009
7010 RETURN
7011
7500 REM ***Box***
7501
7510 LET v(2)=v(2)-x: LET v(3)=v
(3)-y
7520 DRAW v(2),0: DRAW 0,v(3)
7530 DRAW -v(2),0: DRAW 0,-v(3)
7531
7540 RETURN
7541
7600 REM ***Edge***
7601
7610 BORDER v(2)
7611
7620 RETURN
7621
7700 REM ***Circle***
7701
7710 CIRCLE x,y,v(2)
7720 PLOT x,y
```

NEXT a
STOP

The designs are only limited by your imagination.

Now for descriptions of each routine. First the B for box routine. For example:

B3,5

This draws a box between the last plotted point and your two parameters, 3 and 5 in the above example. The C for circle:

C7

This draws a circle, whose radius is given as the parameter and whose centre is the last plotted point.

The E for edge routine, for example:

E6

This changes the colour of the border to that given by the parameter, that is E6 changes it to yellow. The F for forward routine, for example:

F7

This moves the turtle forward a distance given by the parameter, so here the turtle would move seven spaces forward.

The I for ink routine, for example:

I4

This changes the colour of the trail left by the turtle, that is, I4 changes it to green. All colours are as normal on the Spectrum. The M for move routine, for example:

M0,0

SE II

This moves the last plotted position to the specified co-ordinate, in this example, the bottom left-hand corner.

The P for polygon routine, for example:

P5,40,10

This draws a polygon, whose number of sides is given by the first parameter. The first side of that polygon is a line between the last plotted position and the last two parameters. In this example the polygon is a pentagon.

The R for rotate routine, for example:

R90

This changes the direction in which the turtle is heading. Note that the parameter specifies degrees, so here the turtle turns at a right angle to its old direction.

The S for screen routine, for example:

S6,0

This changes both the ink and the paper colours, but leaves the actual picture untouched. The first parameter is ink, and the second one paper. So in this example we have yellow ink on black paper.

Table 1. Name	Letter	Parameter 1	Parameter 2	Parameter 3
Box	B	X co-ord	Y co-ord	
Circle	C	Radius		
Edge	E	Colour		
Forward	F	Distance		
Ink	I	Colour		
Move	M	X co-ord	Y co-ord	
Polygon	P	No. of sides	X co-ord	Y co-ord
Rotate	R	Degrees		
Screen	S	Ink	Paper	

```
7721
7730 RETURN
7731
7900 REM ***Forward***
7901
7910 DRAW xi*v(2),yi*v(2)
7920 LET x=x+xi*v(2)
7930 LET y=y+yi*v(2)
7931
7940 RETURN
7941
8000 REM ***Ink***
8001
8010 INK v(2)
8021
8030 RETURN
8031
8100 REM ***Move***
8101
8110 POKE 23677,v(2)
8115 POKE 23678,v(3)
8120 LET x=v(2): LET y=v(3)
8121
8130 RETURN
8131
8200 REM ***Polygon***
8201
8210 LET oldrad=rad
8220 LET oldxi=xi
8230 LET oldyi=yi
8235 IF x=v(3) THEN LET rad=-PI/
2-PI: GO TO 8245
8240 LET rad=ATN ((y-v(4))/(x-v(
3)))
8245 LET xi=COS rad: LET yi=SIN
rad
8250 LET length=SQR ((x-v(3))*(x
-v(3))+(y-v(4))*(y-v(4)))
8255 LET angle=2*PI/v(2)
8260 FOR i=1 TO v(2)
8265 LET v(2)=length
8270 GO SUB 7910
8275 LET rad=rad+angle
8280 GO SUB 8320
8285 NEXT i
8287 LET rad=oldrad
8288 LET xi=oldxi
8289 LET yi=oldyi
8290
8295 RETURN
8296
8300 REM ***Rotate***
8301
8310 LET rad=rad+(v(2)/180)*PI
8320 LET xi=COS rad
8330 LET yi=SIN rad
8331
8340 RETURN
8341
8400 REM ***Screen***
8401
8410 FOR i=0 TO 21
8420 PRINT AT i,0; INK v(2); PAP
ER v(3); OVER 1;"
8430 NEXT i
8431
8440 RETURN
8441
9000 REM ***TORTOISE***
9001
9010 LET pt=1
9020 LET c$=s$(pt)
9030 IF c$="*" THEN RETURN
9040 LET pt=pt+1
9050 GO SUB 6010
9060 IF c$="b" THEN GO SUB 7510
9070 IF c$="e" THEN GO SUB 7610
9080 IF c$="c" THEN GO SUB 7710
9100 IF c$="f" THEN GO SUB 7910
9110 IF c$="i" THEN GO SUB 8010
9120 IF c$="m" THEN GO SUB 8110
9130 IF c$="p" THEN GO SUB 8210
9140 IF c$="r" THEN GO SUB 8310
9150 IF c$="s" THEN GO SUB 8410
9180 GO TO 9020
9181
9190 REM ***End***
9191
9200 REM ***Initialisation***
9201
9205 LET tort=9000
9210 DIM v(4): DIM s$(50)
9230 LET x=128: LET y=88
9240 LET xi=1: LET yi=0
9250 LET rad=0
9260 LET oldrad=0
9270 LET oldxi=0
9280 LET oldyi=0
9290 LET length=0
9300 LET angle=0
9301
9999 RETURN
```

All that information may be summarised into table 1.

All X,Y co-ordinates are absolute, also colours are as normal on a Spectrum, for example: 0 is black, 7 is white and so on. Now you have seen how to use the program, let us look at the program itself.

Here is a list of the routines used:

200 Interaction. This allows the user to use turtle graphics without using Basic.

6000 Decode. This takes each instruction from s$ and breaks it down into separate parameters. These are then stored in v( ),v(1) holds the number of parameters the first parameter being held in v(2).

7500	Box	7900	Forward	8200	Polygon
7600	Edge	8000	Ink	8300	Rotate
7700	Circle	8100	Move	8400	Screen

9000 Tortoise. This breaks the program into instructions, and then uses Decoce to obtain parameters. It then calls the relevant routine.

9200 Initialisation. This sets up all the variables to their starting values.

Here is a list of all the variables used:

v( )	Holds all the parameters of current instruction
s$	Holds the Tortoise program
tort	Address of Tortoise routine (9000)
x,y	Last plotted position
xi,yi	x and y increment, altered by Rotate
oldxi,oldyi	
rad,oldrad	Direction in radians
length	Length of side of polygon
angle	Angle between sides of polygon
i,a	Loop counts
x1,x2,x3	From, to, step in For-Next loop
pt	Pointer for s$
vi	Index for v( )
ls	Segment of s$
c$	Command letter

Here are some programs to be run in the interaction routine. The three numbers above each line represent the start, end and step for each loop.

(1) 1,72,1
"m128,88:f72:r-5:*"

(2) 1,109,1
"m200-a:f55:r-5:*"

(3) 1,43,1
"fa*2:r90:ca:*"

(4) 3,100,1
"fa:r70:*"

(5) 3,76,1
"fa*2:r123:*"

(6) 1,201,1
"fa:r177:*"

(7) 3,11,1
"m100,0:pa,150,0:*"

(8) 1,112,1
"fa:c4:r80:*"

Note that you will have to re-centre the last plotted position each time you run one of the above. ■


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BBC SQUEEZE

Rem statements, variable names, spaces and lines waste space in your programs. Fintan Culwin piles on the pressure.

THE PROGRAM presented in this article contains four methods of saving space. First, it removes Rem statements; second, it renames all variables and reduces function names to optimised two-character codes — this procedure is known as re-variable — third, it removes all spaces and fourth, it backs up lines.

As it is similar to using a compiler I will borrow the terminology for the rest of this article. The programs that do the compacting I will call the compactor. The program to be compacted will be called the source program and the compacted program produced will be called the object code. Where a variable name is discussed it also means string, floating and integer names and arrays. Where a procedure name is referred to it applies to procedures and functions equally.

The main program is given in listing 1; it requires the machine-code routine produced by listing 2 to be loaded into the machine before the line-pack section is called. There are various places in memory that the code can be loaded into. The most useful place is below Himem for mode 7. But it can be relocated by changing the value of P% in listing 2; this is catered for in the main program's initialisation section.

The most suitable source files for the compactor will be those with large amounts of screen memory. The compactor program itself occupies about 11K in source form and around 6K after it itself has been compacted. It should, in its compacted form, run easily in 16K.

The procedure is first to load the source program. Then reset Page above it by typing

PAGE = PAGE + 256

then Load and Run the compactor program. The compactor asks if the machine-code routine needs to be loaded and, if so, asks where it is to be loaded and then * Loads it. If the source file does not extend beyond &4000 there should be enough space for the compactor program to run. If there is not enough space, then there are two possibilities.

Firstly, the source program can be loaded from a lower address. Page can be reset downward before loading the source program. It is important to remember that 0D00 is not used; 0C00 is the user-defined graphics; 0B00 is the user key definitions and 0900 is the 242 buffer.

To accommodate this the compactor program prompts for the start address of the Basic program to be input. If this is still not enough for your source program, the compactor itself can be split up. Each of the major sections is complete in itself and draws on some of the utility functions included in the utilities section. This is made clear in the program listing.

After the compactor program has been run, it is wise to renumber the file before saving it as a normal Basic program. The object file is virtually unreadable and definitely uneditable so a copy of the source file should be retained for any future development or maintenance.

In order for a program file to be successfully compacted it has to be prepared with the compactor in mind. The rules are:

1. No computed Gosubs or Gotos.
2. No variable names of two characters — three characters within the assembler — not including the terminal % or $.
3. No two-character variable or procedure names.
4. No use of variable names that are identical with assembler mnemonics, LDA, STA and EOR.
5. A space in the assembler after every mnemonic including those that do not require an argument; NOP, ASL, CLC and so on.
6. Variables cannot be used in any * commands if the assembler is not being used then point 4 can be safely ignored.

It is necessary to explain how the Basic interpreter stores the program and organises its variables. Although the program is typed in and displayed as a sequence of ASCII characters, it is stored within the machine in a shorter form.

To achieve this, each Basic keyword is replaced by one or two tokens. These tokens have values greater than 123 (&7B) in order not to be confused with the other alphanumeric parts of the file. Each line of the Basic program is prefaced by four bytes.

The first of these is an end-of-line delineator (&0D). The following two bytes are the line number organised as two parts, high part and low part to the base 255. That is, the line number in decimal is 255 times the high part plus the low part. The last of the four characters is the line length in bytes, including the four-byte overhead, and has a maximum value of &EF (239).

There are a few other points worth noting. The way in which line numbers are referenced is not at all obvious. Referenced line numbers are the line numbers used in Goto and Gosub commands. These numbers are stored as a sequence of four bytes.

The first of these bytes is a token marker having the value

&84 (132)

The following three bytes are the line number

(continued on page 125)

Listing 1. Main program.

```
LIST
  232 MODE 7
 1010 PROC_INITIALISE
 1020 PROC_CONTROL
 1030 STOP
 2000 DEF PROC_CONTROL
 2010 PRINT'" COMPLETE OPTION Y/N";:RESPONSE%=FN_YES_NO
 2020 IF RESPONSE% THEN PROC_MAX:ENDPROC
 2030 PROC_DELAY(5):CLS
 2040 PRINT'"DEBUG ONLY Y/N";:RESPONSE%=FN_YES_NO
 2050 IF RESPONSE% THEN PROC_LITTLE_WINDOW: PROC_DE_REM(DE_BUG%):PROC_DOWN_COPY(
one_SPACE%):PROC_BIG_WINDOW
 2060 PROC_DELAY(5):CLS
 2062 PRINT'"DEREM ONLY Y/N";:RESPONSE%=FN_YES_NO
 2064 IF RESPONSE% THEN PROC_LITTLE_WINDOW: PROC_DE_REM(DE_REM%):PROC_DOWN_COPY(
one_SPACE%):PROC_BIG_WINDOW
 2066 PROC_DELAY(5):CLS
 2070 PRINT '"RE VARIABLE Y/N";:RESPONSE%=FN_YES_NO
 2080 IF RESPONSE% THEN PROC_LITTLE_WINDOW:PROC_RE_VARIABLE:PROC_DOWN_COPY(ALL_O
UT%):PROC_BIG_WINDOW
 2090 PROC_DELAY(5):CLS
 2100 PRINT' "LINE PACK Y/N";:RESPONSE%=FN_YES_NO
 2110  IF RESPONSE% THEN PROC_LITTLE_WINDOW:PROC_LINE_PACK:PROC_DOWN_COPY(ALL_OU
T%):PROC_BIG_WINDOW
 2120 PROC_DOWN_COPY(FINISH%)
 2130 ENDPROC
 3000 DEF PROC_INITIALISE
 3010 FOR N%=0 TO 1 :PRINTTAB(10,N%) CHR$(141)+"COMPACTOR":PRINTTAB(10,N%+2)CHR$
(141)+"CCCCCCCCC":NEXT
 3020 PROC_BIG_WINDOW
 3030 PRINT" LOAD MACHINE CODE SECTION Y/N ";
 3040 RESPONSE%=FN_YES_NO:IF RESPONSE% THEN PROC_CODE_LOAD
 3050 PROC_DELAY(5):CLS
 3060 INPUT"ENTER START ADDRESS OF" '"THE SOURCE FILE &"ADDRESS$
 3070 ADDRESS$="&"+ADDRESS$: START_ADDRESS% = EVAL(ADDRESS$)
 3080 PROC_DELAY(5):CLS
 3100 REM
 3110 REM SPECIAL VALUES SECTION
 3111 VDU 7
 3120 DIM STRING_ARRAY%(2)
 3130 FOR KOUNT%=0 TO 2:STRING_ARRAY%(KOUNT%)=55:NEXT
 3140 DE_BUG%=2
 3150 VDU7
 3160DE_REM%=0
 3170 ALL_OUT%=0
 3180 FINISH%=1
 3190 one_SPACE%=2
 3200PROC%=0
 3210FUN%=1
 3220FLOATING%=2
 3230integer%=3
 3240STRING%=4
 3250 DEBUG$="DEBUG"
 3260 VARIABLE_LENGTH%=3
 3270 ENDPROC
 4000 DEF PROC_BIG_WINDOW:VDU 28,0,23,39,5: ENDPROC
 4010 DEF PROC_LITTLE_WINDOW:VDU 28,0,20,39,18: ENDPROC
 4020 DEF PROC_DELAY(FACTOR%):ENDPROC:FOR N%=1 TO 2 :PRINTTAB(5) CHR$(141)+CHR$(
136)+"PLEASE WAIT": NEXT
 4030 TIME=0: REPEAT: UNTIL TIME>100*FACTOR% :ENDPROC
 4040 DEF FN_YES_NO
 4050 LOCAL RESPONSE% :REPEAT  RESPONSE%=GET OR  &20 :UNTIL RESPONSE%=121 OR RES
PONSE%=110
 4060 IF RESPONSE%=121 THEN =TRUE ELSE =FALSE
 4070 DEF PROC_CODE_LOAD
 4080 PRINT '"LOAD BELOW HIMEM Y/N";:RESPONSE%=FN_YES_NO
 4090 IF RESPONSE% THEN HIMEM=HIMEM-150:M%=HIMEM:GOTO 4110
 4100 INPUT '"ENTER LOAD/EXECUTION ADDRESS &"ADDRESS$:ADDRESS$="&"+ADDRESS$:M%=E
VAL(ADDRESS$)
 4110 PRINT CHR$(136)"MAKE SURE YOU LOAD CORRECT TAPE !"
 4120 *OPT 1,2
 4130 PROC_LITTLE_WINDOW
 4140 *LO.""
 4160 PROC_BIG_WINDOW:CLS
 4170 ENDPROC
 4500 DEF PROC_MAX
 4510 PROC_LITTLE_WINDOW
 4520 PROC_DE_REM(DE_REM%)
 4530 PROC_DE_REM(DE_BUG%)
 4540 PROC_RE_VARIABLE
 4550 PROC_DOWN_COPY(ALL_OUT%)
 4560 PROC_LINE_PACK
 4570 PROC_DOWN_COPY(FINISH%)
 4575 PROC_BIG_WINDOW
 4580 ENDPROC
```

(listing continued on page 125)

(continued from page 123)

itself coded from two into three bytes. Acorn gives two reasons for this. Firstly, the coding avoids any confusion between line codes and tokens. Secondly, the coding allows for a rapid renumbering algorithm to be used. The decoding algorithm is:

Assembler		Basic
LDA	BYTE1	TEMP% = ?BYTE1%
ASL	A	TEMP% = TEMP%*4
ASL	A	FACTOR% = TEMP% AND αl0
STA	TEMP	LOW% = FACTOR% EOR?BYTE2%
AWD	#&C0	TEMP% = TEMP%*4
EOR	BYTE2	
STA	LOW	HIGH% = TEMP% EOR ?BYTE3%
LDA	TEMP	LINE NUMBER = 255*HIGH% + LOW%
ASL	A	
ASL	A	
EOR	BYTE3	
STA	HIGH	

where bytes 1, 2 and 3 are the three locations following the &84 token. The method by which the variables are stored is a consideration to minimise the execution time of a Basic program.

The resident integer variables are always stored in locations &0400 (@%) to &047C (Z%). Other variables are identified by using their initial character as a pointer to an entry address lying in the range &0480 to &04F5. Each of these entry points indicates the location of the value of the first variable — the text of the variable name — having that initial letter.

It also contains a pointer to the next value and a further value. To look up the value of a variable, the interpreter uses the initial character to find the first name, attempts to match the names and carries on down the list until the variable is matched, or the end of the list is encountered.

The program commences its run by asking if the machine-code routine is installed and, if not, where to load it. If the source file does not occupy space below &E00, then it is probably wisest to load the Page &0D00 where it is safe against an accidental mode change or hard reset. If this is not possible, then it can be loaded below Himen for mode 7, but it will be lost if a change of mode or a hard reset is made. The program then asks if you wish to use all the options. If you do not, then all the sections are presented separately.

The first of these is the de-Rem option which merely removes Rem statements where they occur. But if the first word after the Rem is "debug" it will remove the whole line. This is followed by a down-copy option which leaves one space only between statements. This option is useful for the development of programs where some sections or lines are left in for de-bug purposes only.

The re-variable option, which renames all variables and procedures which are above the mininal length, follows. The down-packing

(continued on page 127)

Listing 1 continued from page 123.

```
5000DEFPROC_DE_REM(OPTION%)
5010 LOCAL SYMBOL%,FLAG%,ADDRESS%,ASSEMBLER%
5015 PRINT "DE REMMING option _";: IF OPTION%=DE_BUG% THEN PRINT " DE bugging"
ELSE PRINT "DE remming"
5020FLAG%=FALSE
5030 ASSEMBLER%=FALSE
5040ADDRESS%=START_ADDRESS%
5050REPEAT
5060ADDRESS%=ADDRESS%+4
5070 REPEAT
5080 SYMBOL%=?ADDRESS%
5090 IF SYMBOL%=&0D THEN ADDRESS%=ADDRESS%+3
5100 IF SYMBOL%=34 THEN ADDRESS%=FN_ENDQUOTES(ADDRESS%,FALSE)
5110 IF SYMBOL%=&F4 THEN ADDRESS%=FN_REM_CRUNCH(OPTION%,ADDRESS%)
5120 IF SYMBOL%=93 OR SYMBOL%=91 THEN ASSEMBLER%=NOT ASSEMBLER%
5130 IF SYMBOL%=92 AND ASSEMBLER% THEN ADDRESS%=FN_REM_CRUNCH(OPTION%,ADDRESS%)

5140 ADDRESS%=ADDRESS%+1
5150 UNTIL ?(ADDRESS%)=&0D
5160 UNTIL ?(ADDRESS%+1)=&FF
5170 ENDPROC
5200 = NOT  THIS_LINE%
5300 DEFFN_REM_CRUNCH(OPTION%,ADDRESS%)
5310 IF DEBUG$=FN_GET_STRING(ADDRESS%) THEN option%=TRUE ELSE option%=FALSE
5320 IF option% AND OPTION%=DE_BUG%THEN ADDRESS%=FN_START_LINE(ADDRESS%):ADDRES
S%=FN_END_LINE(ADDRESS%)::GOTO 5340
5330 IF OPTION%=DE_REM% AND NOT option% THEN ADDRESS%=FN_END_LINE(ADDRESS%)

5340 =ADDRESS%
5400 DEFFN_END_LINE(ADDRESS%)
5410 LOCAL SYMBOL%
5420 REPEAT
5430 SYMBOL%=?ADDRESS%
5440 ?ADDRESS%=32
5450 ADDRESS%=ADDRESS%+1
5460 UNTIL ?ADDRESS%=&0E
5470 =ADDRESS%-1
5500 DEFFN_START_LINE(ADDRESS%)
5510 REPEAT
5520 ADDRESS%=ADDRESS%-1
5530 UNTIL ?ADDRESS%=&0D
5540=ADDRESS%
5600 DEFFN_NOT_SPACE(ADDRESS%)
5610 REPEAT
5620 ADDRESS%=ADDRESS%+1
5630 UNTIL ?ADDRESS%<>32
5640=ADDRESS%
10000 DEF PROC_RE_VARIABLE
10010 LOCAL ASSEMBLER%:ASSEMBLER%=FALSE
10020 ADDRESS%=START_ADDRESS%
10030 REPEAT
10040 ADDRESS%=ADDRESS%+4
10050 REPEAT
10060 ADDRESS%=FN_Q_STAR(ADDRESS%)
10070 IF ?ADDRESS%<&7B AND FN_START_CHR(?ADDRESS%) THEN ADDRESS%=FN_ONE_VAR(ADDR
ESS%)
10080 IF ?ADDRESS%=34 OR ?ADDRESS%=&F4 THEN ADDRESS%=FN_ENDQUOTES(ADDRESS%,ASSEM
BLER%)
10090 IF ?ADDRESS%=92 AND VARIABLE_LENGTH%=4 THEN ADDRESS%=FN_ENDQUOTES(ADDRESS%
)
10100 IF ?ADDRESS%=&0D THEN ADDRESS%=ADDRESS%+3
10110 IF ?ADDRESS%=38 THEN ADDRESS%=FN_HEX(ADDRESS%)
10120 IF ?ADDRESS%=91 THEN VARIABLE_LENGTH%=4
10130 IF ?ADDRESS%=93  THEN VARIABLE_LENGTH%=3
10140 IF ?ADDRESS%=91 OR ?ADDRESS%=93 THEN ASSEMBLER%=NOT ASSEMBLER%
10150 ADDRESS%=ADDRESS%+1
10160 UNTIL ?ADDRESS%=&0E
10170 UNTIL ?(ADDRESS%+1)=&FF
10180 ENDPROC
10200 DEF FN_ONE_VAR(ADDRESS%)
10210 LOCAL TEST$,SYMBOL%,count%
10220 TEST$=CHR$(?ADDRESS%)
10230 TYPE%=FN_LOOK_BACK(ADDRESS%)
10240 count%=1
10250 REPEAT
10260 SYMBOL%=?(ADDRESS%+count%)
10270 IF FN_VAL_CHR(SYMBOL%) THEN TEST$=TEST$+CHR$(SYMBOL%)
10280 count%=count%+1
10290 UNTIL NOT FN_VAL_CHR(SYMBOL%)
10300 length%=LEN(TEST$)
10310 IF TYPE%=5 THEN TYPE%=FN_TYPE_VAR(TEST$)
10320 IF TYPE%>FLOATING% THEN length%=length%-1
10330 IF VARIABLE_LENGTH%=4 AND length%=3 THEN ?(ADDRESS%+3)=0
10340 IF length%< VARIABLE_LENGTH% THEN 10380
10350 REPLACE$=FN_MAKE_STRING(TYPE%)
10360 PRINT"REPLACING ";TEST$;" WITH ";REPLACE$
10365 IF TYPE%=PROC% THEN PRINT "PROC " ELSE IF TYPE%= FUN% THEN PRINT " FUNCTIO
N " ELSE IF TYPE%= FLOATING% THEN PRINT " FLOATING " ELSE IF TYPE%= integer% THE
N PRINT " INTEGER " ELSE PRINT" STRING "
10370 PROC_REPLACE(TEST$,REPLACE$,ADDRESS%)
10380 =ADDRESS%+count%-1
10400DEFPROC_REPLACE(old$,new$,ADDRESS%)
10410 LOCAL MARK%,ASSEMBL3R%
10420 MARK%=FALSE
10430 IF VARIABLE_LENGTH%=3 THEN ASSEMBLER%=FALSE ELSE ASSEMBLER%=TRUE
10440 IF TYPE%<FLOATING% THEN REPEAT ADDRESS%=ADDRESS%-1:UNTIL ?ADDRESS%=&A4 OR
?ADDRESS%=&F2
10450REPEAT
10460 SYMBOL%=?ADDRESS%
10470 IF SYMBOL%=91 OR SYMBOL%=93 THEN ASSEMBLER%=NOT ASSEMBLER%
10480IF FN_START_CHR(SYMBOL%) AND TYPE%>FUN%THEN ADDRESS%=FN_TEST_STRING(ADDRESS
%)
10490 IF SYMBOL%=&A4 AND TYPE%=FUN% THENADDRESS%=FN_TEST_STRING(ADDRESS%+1)
10500 IF SYMBOL%=&F2 AND TYPE%=PROC% THENADDRESS%=FN_TEST_STRING(ADDRESS%+1)
10510IF SYMBOL%=34 OR SYMBOL%=&F4 THEN ADDRESS%=FN_ENDQUOTES(ADDRESS%,ASSEMBLER%
)
10520 IF SYMBOL%=92 AND ASSEMBLER% THEN ADDRESS%=FN_ENDQUOTES(ADDRESS%,ASSEMBLER
%)
10530IF SYMBOL%=&0D THEN ADDRESS%=ADDRESS%+3
10540 IF SYMBOL%=38 THEN ADDRESS%=FN_HEX(ADDRESS%)
10550 ADDRESS%=ADDRESS%+1
10560 IF SYMBOL%=&0D THEN IF ?ADDRESS%=&FF MARK%=TRUE
10570 IF SYMBOL%=&0D THEN  ADDRESS%= ADDRESS%+3 :ADDRESS%=FN_Q_STAR(ADDRESS%)
10580UNTIL MARK%
10590 ENDPROC
10700DEF PROC_REP(ADDRESS%,old$,new$)
10710 IF ASSEMBLER% THEN new$=new$+CHR$(0)
10720 $ADDRESS%=new$
10730 FOR N%=1 TO LEN(old$)-LEN(new$)
10740 ?(ADDRESS%+LEN(new$)+(N%-1))=32
10750NEXT
10760 ENDPROC
10900 DEF FN_MAKE_STRING(IND%)
10910 LOCAL IND$,TEST$
10920 IF IND%=integer% THEN IND$="%": ELSE IF IND%=STRING% THEN IND$="$" ELSE IN
D$=""
10930 IF IND%>=FLOATING% THEN IND%=FLOATING%
10940  number%=STRING_ARRAY%(IND%)
10950 STRING_ARRAY%(IND%) = STRING_ARRAY%(IND%) + 1 :IF STRING_ARRAY%(IND%) MOD
54 = 0 THEN 10950
10960 FIRST_CHR%=number% MOD 54
10970 SECOND_CHR%=number% DIV 54
10980 FIRST_CHR$=FN_MAKE_CHR(FIRST_CHR%)
10990 SECOND_CHR$=FN_MAKE_CHR(SECOND_CHR%)
11000 TEST$=FIRST_CHR$ + SECOND_CHR$
11010 IF INSTR("NIFLNONORPITO",TEST$)=1 THEN TEST$=FN_MAKE_STRING(FLOATING%)
11020 =TEST$+IND$
11100 DEF FN_MAKE_CHR(number%)
11110 IF number%<27 THEN= CHR$(64+number%)
11120 =CHR$(94+(number%-26))
11200 DEFFN_TEST_STRING(ADDRESS%)
11210 LOCAL TEST$: TEST$=FN_GET_STRING(ADDRESS%-1)
11220 IF TEST$=old$ THEN PROC_REP(ADDRESS%,old$,new$)
11230 = ADDRESS%+LEN(TEST$)-1
11240
11250 DEF FN_HEX(ADDRESS%)
11260 REPEAT
11270 ADDRESS%=ADDRESS%+1
11280 UNTIL NOT FN_VAL_CHR(?ADDRESS%)
11290 =ADDRESS%-1
11300 DEF FN_LOOK_BACK(ADDRESS%)
11310 REPEAT
11320 ADDRESS%=ADDRESS%-1
11330 UNTIL ?(ADDRESS%)<>32
11340 IF ?ADDRESS%=&A4 THEN = FUN% ELSE IF ?ADDRESS%= &F2 THEN = PROC% ELSE = 5
11350 DEF FN_TYPE_VAR(TEST$)
11360 LOCAL right$: right$=RIGHT$(TEST$,1)
11370 IF  right$="%" THEN = integer%
11380 IF  right$="$" THEN = STRING%
11390 = FLOATING%
15000DEFPROC_LINE_PACK
15010LOCAL ADDRESS%,O_K%,CHR_COUNT%,CHR_COUNT_LOC%,LAST_LINE%,THIS_LENGTH%
15020 CHR_COUNT%=FN_Q_STAR(START_ADDRESS%):IF CHR_COUNT%=START_ADDRESS% THEN LAS
T_LINE%=FALSE ELSE THEN LAST_LINE%=TRUE
15030ADDRESS%=FN_NEXT_LINE(START_ADDRESS%)
15040CHR_COUNT%=?(START_ADDRESS%+3):CHR_COUNT_LOC%=START_ADDRESS%+3:THIS_LENGTH%
=?(ADDRESS%+3)
15050REPEAT
15060O_K%=FN_OK_LINE(ADDRESS%)
15061 IF NOT O_K% THEN PRINT"BREAKING "
15070IF O_K% THEN CHR_COUNT%=CHR_COUNT% + THIS_LENGTH% - 3 :!ADDRESS%=&20202020:
?(ADDRESS%+3)=&20:?ADDRESS%=58
15080 IF NOT O_K% THEN ?CHR_COUNT_LOC%=CHR_COUNT%:CHR_COUNT%=?(ADDRESS%+3):CHR_C
OUNT_LOC%=ADDRESS%+3
15090 ADDRESS%=ADDRESS%+THIS_LENGTH%:THIS_LENGTH%=?(ADDRESS%+3)
15095 PRINT"LINE NUMBER ";255*?(ADDRESS%+1)+?(ADDRESS%-2)
15100 UNTIL ?(ADDRESS%+1)=&FF
15105 ?CHR_COUNT_LOC%=CHR_COUNT%
15110 ENDPROC
15200DEF FN_OK_LINE(ADDRESS%)
15210LOCAL TEST%,THIS_LINE%
15220 THIS_LINE%=FALSE
15225  IF LAST_LINE% THEN THIS_LINE%=TRUE: LAST_LINE%=FALSE
15230IF ?(ADDRESS%+4)=42 THEN THIS_LINE%=TRUE:LAST_LINE%=TRUE
15235 IF ?(ADDRESS%+4)=&DD THEN THIS_LINE%=TRUE
15240IF NOT THIS_LINE% AND (CHR_COUNT%+?(ADDRESS%+3)>230)THEN THIS_LINE%=TRUE
15250  TEST%=FN_LOOK_IF(ADDRESS%)
15255 IF TEST% THEN LAST_LINE%=TRUE
15270 IF NOT THIS_LINE% THEN THIS_LINE%=FN_LINE_REF(ADDRESS%)
15280 = NOT  THIS_LINE%
15300 DEF FN_LOOK_IF(ADDRESS%)
15310   LOCAL FOUND%,count%,
```

(listing continued on page 127)

ANIROG SOFTWARE

KRAZY KONG

An E-XPANDE-D screen, large graphics, rolling barrels, hammer, fireballs, lifts, handbags and umbrellas as you try to rescue the damsel Kong has abducted. Spectacular collapse of Kong's lair in the fourth screen. Uses all 21K of your expanded Vic for this 100% M/C thriller. Complete with high score table.

KB/JS VIC 20 16K £7.90

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For UNEXP from the writer of Krazy Kong comes the equally brilliant Mini-Kong. You will wonder how he managed to cram so much in the unexpanded VIC.
Brilliant multi-colour graphics, expanded screen, lift, rolling barrels, ladders, running score/HI-score and not to forget the hand bag bonus in this all M/C presentation.

K.B./J.S. VIC 20 UNEXP £5.95

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An E-XPANDED-D screen presentation with superb action packed space thriller, written entirely in machine code with four action packed stages. To destroy the power source of Xeno II you have to fight off waves of robot attack, plasma bombing by the legions of the outer sanctum and finally attack the power source protected by a force field, continuous bombardment by guardians and blockading by wild whirling suicidal space ships. Truly a game for all arcadians.

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Your starcruiser badly damaged in a meteor storm is forced to crash land on the planet ruled by ZOK a time space generated image of Dracula. You are challenged to a battle of wits and endurance as the battle for survival starts in earnest in this big multi-screen graphical adventure in hi-res graphics and M/C movements.

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NEW

THE DUNGEONS

Enter the realms of fantasy with this superb high resolution, multi-colour graphical text adventure. Choose your role as a fighter with armour or a magician with spells to do battle with the fearfull fire breathing RED DRAGON and many other horrific monsters in THE DUNGEONS with 100 rooms, many with ingeneous traps. First of the text adventures that will keep you enthralled and frustrated for a very long time if you use the fast save facility or give up and have a new advent-ure.

K.B. VIC 20 16K £5.95

FROGRUN

Popular arcade game. All machine code with brilliant colour graphics and sound effect. Features include snakes, crocodiles, lady frogs, turtles, cars, lorries and logs.

KB/JS VIC 20 Unexp. £5.95
KB/JS SPECTRUM 16K/48K £4.95
KB/JS COMMODORE 64 £5.95

DOTMAN

Ghosts chase you as you try to eat the dots and collect points. You can turn the tables on them by eating the pills. Don't forget the ghosts have been given intelligence and will try to corner you. This feature makes Dotman exciting and challenging. All M/C game complete with running and highest scores and tunnels.

JS/KB VIC 20 Unexp. £5.95

CAVERN FIGHTER

All M/C version of SCRAMBLE

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GALACTIC ABDUCTORS

A stunning action packed game which uses all of your TV screen for the superb large animated graphics. Giant Space Hawks whirl and weave in intricate patterns as they drop their deadly homing mines which will destroy your base on contact. While you are busy defending yourself the Hawks will feed on your helpless population, returning only their skulls. All M/C game complete with high score table that will blow your mind with its graphics and sound effects.

JS VIC 20 16K £7.90

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KB/JS SPECTRUM 16K/48K £7.95

TINY TOT'S SEVEN

Super games pack for younger children with bright colour graphics and sound effects. Everybody's favourite Simon plus Super Snap, O's and X's, Word Jumble, Bomber, Duck Shoot and Mad Drivers.

KB SPECTRUM 16K/48K £4.95
KB VIC 20 Unexp. £5.95

PHARAOH'S TOMB

Once you enter the only way out is with the aid of a key which unlocks the mystery of the Pharaoh's tomb. Beware of the mantraps the ancient Egyptians so painstakingly built. One false move and you will meet the same fate as befell other tomb robbers over thousands of years. A multi-screen big graphical adventure with M/C movements.

KB VIC 20 16K £5.95

CRAWLER

All M/C version of Centipede

JS VIC 20 Unexp. £5.95

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(continued from page 125)

option following does not allow any spaces to be left in the program. If the line-packing option is not chosen following this, then

PROC-DOWN-COPY (FINISH%)

should be entered from the keyboard after the program has finished. If the assembler is involved in the source program. The final option presented is to pack lines together. If this option is chosen then the machine-code routine must be installed in the computer.

The first of the working sections is de-Rem — Option%. The option is either to debug or de-Rem as already explained. The section proceeds by initialising a local variable address% to the Start address and then stepping through the whole of the source file in two repeat-until loops. The inner loop steps through each line and terminates when the end of file marker — &00 followed by &FF — is found.

Within each line the address is incremented, skipping three positions if a reference line number token (&84) is found; and to the end of quotes, if a quote symbol (&22) ASCII 34 is found. If the line detects the Rem token (&F4) then, depending on the option, either the rest of the line is replaced with spaces, or the whole line is replaced with spaces. This is done by

FN-REM-CRUNCH

which uses FN-Get-String to examine the first

(continued on page 129)

Listing 1 continued from page 125.

```
15320 ADDRESS%=ADDRESS%+3:count%=3
15330 REPEAT
15340IF ?ADDRESS% = &E7 OR ?ADDRESS%= &F4 THEN FOUND%=TRUE
15370  IF?ADDRESS% =&8D THEN ADDRESS%=ADDRESS%+3
15380ADDRESS%=ADDRESS%+1:count%=count%+1
15390UNTIL  count%=THIS_LENGTH%
15410 =FOUND%
15500DEF FN_LINE_REF(ADDRESS%)
15510LOCAL line_NUM%
15520 line_NUM%=255*?(ADDRESS%+1) + ?(ADDRESS%+2)
15540 CALL M%,START_ADDRESS%,line_NUM%
15550 IF ?&70=&FF THEN = TRUE ELSE = FALSE
15600  DEF FN_NEXT_LINE(ADDRESS%)
15610 ADDRESS%=ADDRESS%+4
15620 REPEAT
15630 IF ?ADDRESS%=&8D THEN ADDRESS%=ADDRESS% +3
15640 ADDRESS%=ADDRESS%+1
15650 UNTIL ?ADDRESS%=&0D
15660 =ADDRESS%
20000DEFPROC_DOWN_COPY(OPTION%)
20010 PRINT"STARTING DOWN COPY "
20020 IF OPTION%=ALL_OUT% THEN PRINT"ALL SPACES OUT " ELSE IF OPTION%=one_SPACE%
 THEN PRINT" ONE SPACE LEFT " ELSE PRINT" FINISHING "
20030 LOCAL ASSEMBLER%
20040  ASSEMBLER%=FALSE
20050ADDRESS%=START_ADDRESS%
20060FRONT_ADDRESS%=ADDRESS%
20070REPEAT
20080 START_LINE%=ADDRESS%
20090 CHR_COUNT%=0
20100 START_LINE%=!FRONT_ADDRESS%
20110FRONT_ADDRESS%=FRONT_ADDRESS%+4
20120 ADDRESS%=ADDRESS%+4
20130 REPEAT
20140 IF ?FRONT_ADDRESS%<>32 THEN ?ADDRESS%=?FRONT_ADDRESS%:ADDRESS%=ADDRESS%+1:
CHR_COUNT%=CHR_COUNT%+1
20150 IF (?(ADDRESS%-1)=58 AND ?(ADDRESS%-2)=58) THEN ADDRESS%=ADDRESS%-1: CHR_C
OUNT%=CHR_COUNT%-1
20160 IF OPTION%=one_SPACE% AND ?FRONT_ADDRESS%=32 AND NOT (?(ADDRESS%-1)=32) TH
EN ?ADDRESS%=?FRONT_ADDRESS%:ADDRESS%=ADDRESS%+1:CHR_COUNT%=CHR_COUNT%+1
20170 IF ?FRONT_ADDRESS%=91 OR ?FRONT_ADDRESS%=93 THEN ASSEMBLER%=NOT ASSEMBLER%
20180 IF OPTION%=FINISH% AND ?(ADDRESS%-1)=0 THEN ?(ADDRESS%-1)=32
20190  IF ?FRONT_ADDRESS%=34 OR ?FRONT_ADDRESS%=&F4 THEN  PROC_STRING_COPY
20200  IF ?FRONT_ADDRESS%=92 AND ASSEMBLER% THEN PROC_STRING_COPY
20210 FRONT_ADDRESS%=FRONT_ADDRESS%+1
20220 UNTIL ?FRONT_ADDRESS%=&0D
20230 ?(START_LINE%+3)=CHR_COUNT%+4
20240IF CHR_COUNT%=1 AND ?(ADDRESS%-1)=58 THEN ADDRESS%=START_LINE%
20250 IF CHR_COUNT%=0 THEN ADDRESS%=START_LINE%
20260 UNTIL ?(FRONT_ADDRESS%+1)=&FF
20270 ?ADDRESS%=&0D:?(ADDRESS%+1)=&FF
20280 ENDPROC
20290
20300 DEFPROC_STRING_COPY
20310 LOCAL SYMBOL%
20320 FRONT_ADDRESS%=FRONT_ADDRESS%-1
20330 REPEAT
20340 SYMBOL%=?FRONT_ADDRESS%
20350 ?ADDRESS%=SYMBOL%
20360 FRONT_ADDRESS%=FRONT_ADDRESS%+1
20370 ADDRESS%=ADDRESS%+1
20380 CHR_COUNT%=CHR_COUNT%+1
20390 UNTIL SYMBOL%=34 OR SYMBOL%=&0D
20400 FRONT_ADDRESS%=FRONT_ADDRESS%-1
20410 IF SYMBOL%=&0D THEN FRONT_ADDRESS%=FRONT_ADDRESS%-1: ADDRESS%=ADDRESS%-1:C
HR_COUNT%=CHR_COUNT%-1
20420 ENDPROC
25000 DEFFN_ENDQUOTES(ADDRESS%,ASSEMBLER%)
25010 REPEAT
25020 ADDRESS%=ADDRESS%+1
25030 UNTIL ?ADDRESS%=34 OR ?ADDRESS%=&0D OR (ASSEMBLER% AND ?ADDRESS%=58)
25040 =ADDRESS%
25100 DEFFN_START_CHR(SYMBOL%)
25110 IF(SYMBOL%>64 AND SYMBOL%<91) OR (SYMBOL%>94 AND SYMBOL%<123) THEN = TRUE
ELSE = FALSE
25119 DEF FN_GET_STRING(ADDRESS%):ADDRESS%=ADDRESS%+1
25120 LOCAL SYMBOL%,TEST$  :  TEST$=""
25130 IF ?ADDRESS%=32 THEN ADDRESS%=FN_NOT_SPACE(ADDRESS%)
25140 REPEAT
25150 SYMBOL%=?ADDRESS%
25160 TEST$=TEST$+CHR$(SYMBOL%)
25170 ADDRESS%=ADDRESS%+1
25180 UNTIL NOT FN_VAL_CHR(?ADDRESS%)
25190 =TEST$
25200 DEF FN_VAL_CHR(SYMBOL%)
25210 IF (FN_START_CHR(SYMBOL%) OR ( SYMBOL%>47 AND SYMBOL%<58)) OR SYMBOL%=36 O
R SYMBOL%=37 THEN = TRUE ELSE = FALSE
25300 DEF FN_D_STAR(ADDRESS%)
25310 LOCAL O_ADDRESS% : O_ADDRESS%=ADDRESS%
25320 IF ?ADDRESS%=32 THEN ADDRESS%=FN_NOT_SPACE(ADDRESS%)
25330 IF ?ADDRESS%<>42 THEN : =O_ADDRESS%
25340 ADDRESS%=FN_ENDQUOTES(ADDRESS%,1)
25350 =ADDRESS%+4
```

(continued from page 127)

word of the Rem statement. Its debug option is chosen and if the first word is Debug then FN-Start-Line is followed by FN-End-Line; or else FN-End Line is called directly.

The routine also contains a switch called Assembler% which is turned on or off by the occurrence of the assembler markers. If the switch is on, then the assembler comment delineator is acted on in the same way; but the blanking-out of lines can finish when a multi-line delineator is found.

This section is followed by the re-variable section which renames all variables. Its stepping routine is largely identical to that of de-Rem, the major differences are that lines beginning with A* are left intact.

Hex numbers are skipped over as the system cannot decide between variable ABCD and number ABCA. The assembler delineators are also used to change the value of the variable string-length; which is used to decide if an encountered variable is long enough to be replaced. The main action routine

FN-ONE-VAR

is called when a valid start character is encountered. One-Var firstly attempts to identify the type of variable/name by looking backwards for the FN or Proc token (&A4 and &F2). If these are found, then the Type% attribute can be set. After the string has been extracted, then the new string is produced by

FN-MAKE-STRING

The string is produced by a number from the array string-array%(2). 0 is for function; 1 for procedures and 2 for variables.

```
10 CLS
20 PRINTTAB(6,3)"LINE CRUNCHER"''
30 PRINTTAB(2)"ASSEMBLER ROUTINE TO "
40 PRINTTAB(2)"SEARCH FOR GIVEN LINE NUMBER"
50 PRINTTAB(2)"STARTING FROM GIVEN ADDRESS."'
60PRINTTAB(2)"LOADS INTO MEMORY BELOW MODE 7"
70 PRINTTAB(2)"HIMEM. ON ENTRY FIRST INTEGER"
80 PRINTTAB(2)"PARAMETER IS START ADDRESS"
90 PRINTTAB(2)"OF FILE; SECOND IS LINE NUMBER."
100 PRINTTAB(2)"ON EXIT LOCATION &70 SET TO &FF"
110 PRINTTAB(2)"FOR SUCESS AND &00 FOR FAILURE."'
120 PRINTTAB(2)"USES ABSOLUTE ADDRESSING METHODS;"
130 PRINTTAB(2)"AND IS NON RELOCATABLE"
140 PRINTTAB(2,23)"PRESS THE SPACE BAR TO START";
150 REPEAT:RESPONSE%=GET:UNTIL RESPONSE%=32
160 MODE 7
170 HIMEM=HIMEM-155
180 DIM P%155
190 BASE%=&600
200 ADD%=&74
210 INDIC%=&70
220 FOR POT%=0 TO 3 STEP 3
230 P%=HIMEM
240[OPT POT%
250.START%
260LDA BASE%+1
270STA &70
280LDA BASE%+2
290STA &71
300LDA BASE%+4
310STA &72
320LDA BASE%+5
330STA &73
340LDY £0
350LDA (&70),Y
360STA &74
370LDA (&72),Y
380STA &76
390INY
400LDA (&70),Y
410STA &75
420LDA (&72),Y
430STA &77
440LDA £&0F
450STA INDIC%
460.nextone
470JSR INCADD
480LDY £0
490LDA (ADD%),Y
500CMP £&0D
510BNE JUMPOVER
520JSR FINISH
530.JUMPOVER
540CMP £&0D
550BNE JUMPOVER2
560JSR TEST
570.JUMPOVER2
580LDA &70
590CMP £&FF
600BEQ FINISHED
610CMP £&0
620BEQ FINISHED
630JMP nextone
640.FINISHED
650RTS
660.FINISH
670PHA
680JSR INCADD
690LDY £0
700LDA (ADD%),Y
710CMP £&FF
720BNE JUMPOVER4
730LDA £0
740STA INDIC%
750.JUMPOVER4
760PLA
770RTS
780.INCADD
790CLC
800LDA &74
810ADC £1
820STA &74
830LDA &75
840ADC £0
850STA &75
860RTS
870.TEST
880LDY £1
890LDA (&74),Y
900ASL A
910ASL A
920STA &71
930AND £&C0
940INY
950EOR (&74),Y
960STA &72
970LDA &71
980ASL A
990ASL A
1000INY
1010EOR (&74),Y
1020STA &73
1030CMP &77
1040BEQ PERHAPS
1050RTS
1060.PERHAPS
1070LDA &72
1080CMP &76
1090BEQ CERTAIN
1100RTS
1110.CERTAIN
1120LDA £&FF
1130STA &70
1140RTS
1150]
1160 NEXT
1170 RESPONSE%=GET
1180 CLS :PRINTTAB(6,3)"CODE ASSEMBLED"''
1190 PRINTTAB(2)"PRESS S TO MAKE A COPY"
1200 PRINTTAB(2)"OF THE OBJECT CODE."''
1210 REPEAT
1220 RESPONSE%=GET
1230 RESPONSE%=RESPONSE% OR &20
1240 UNTIL RESPONSE%=&73
1250 *OPT 1,2
1260 *SAVE "LINECRUNCH" 7856 7C01
1270 *OPT 1,1
```

Listing 2. Line cruncher.

Within the assembler two other considerations apply. Firstly, the interpreter stores op-codes as three ASCII characters, not as a token. To avoid these being re-variabled then the minimum length of variables which will trigger Proc-Replace is increased from three to four. Any three-character variables outside the assembler will cause the op-codes to be re-variabled with disastrous consequences. Accordingly variables such as LDA, ASC, etc, should not be used if the assembler is being used. Secondly, a space must separate the code from the address in assembler, to avoid the compactor recognising it as a variable. To prevent this space from being removed by the line-pack routine it is replaced by

CHR$ 0

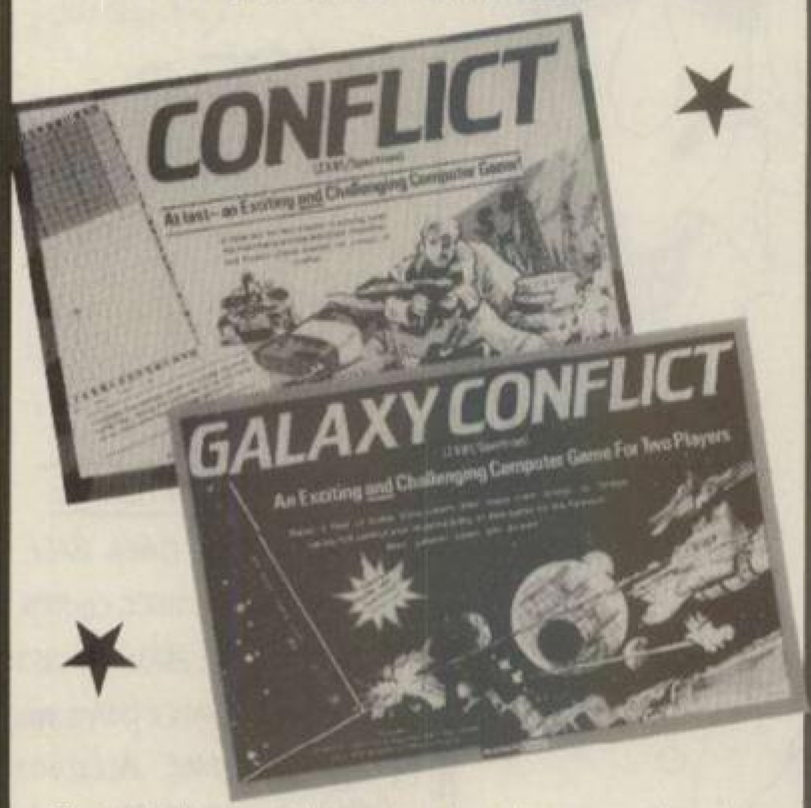
in re-variable and changed back in down copy: Finish%.

The system does not discriminate between codes which require an address and those which do not — so a space must follow all codes. The line-packing routine works by replacing the four-byte line delineator with a colon and three spaces. Lines which start with an asterisk have to be left alone in their entirety. Lines which include an If or Rem statement have to be the last old line packed on to the end of the new line. Any line which starts with a Def statement or which is referenced by a Gosub or Goto has to be put at the start of a new line. ■

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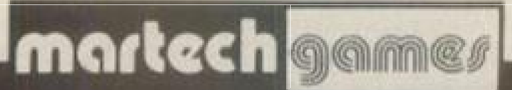


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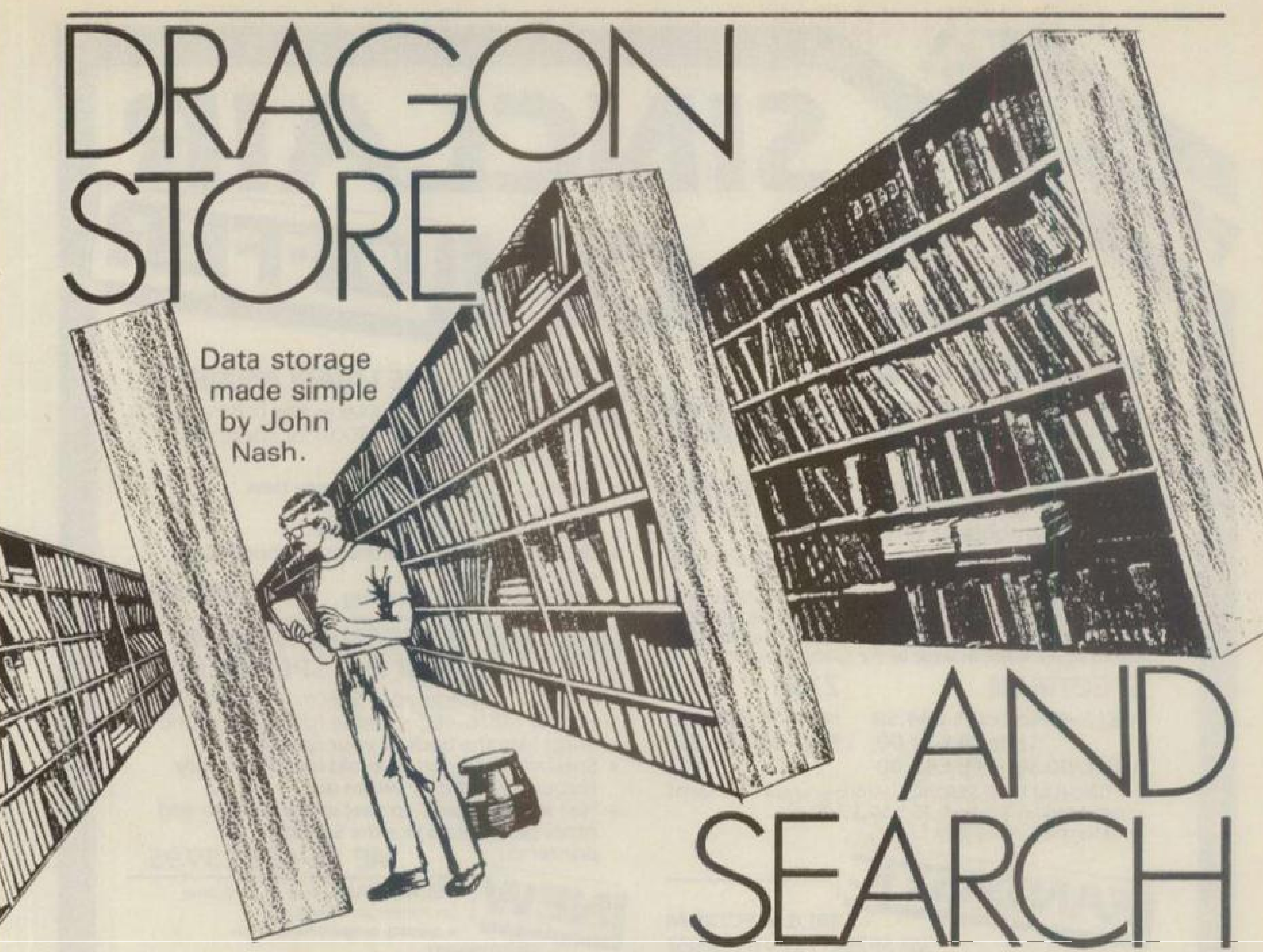
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For first-time loading, switch the machine off, then on, and load the decimal machine codes using the program supplied. Note that the code must be loaded from Address 2943 — decimal. There are 150 bytes to load. Before doing anything else, save this to tape as a machine code file

CSAVEM"MC",2943,3093,150

Now turn the machine off, then on, type

POKE25,6

enter New, enter and load the Basic program as listed. Do not add any spaces as memory is tight. Finally, Save the Basic file in the usual way.

Program for loading decimal machine codes.

```
1 REM MACHINE CODE DECIMAL/HEX. LOADER
2 REM PUT CODES (DEC. OR HEX.) INTO DATA STATEMENTS,
3 REM AS MANY AS YOU NEED, BETWEEN LINES 10 - 49.
4 REM SET THE PARTITION, E.G. CLEAR1000,32250 THEN RUN THIS PROGRAM
          AND ANSWER THE PROMPTS.
5 REM EXAMPLE: FOR THE FIRST BLOCK OF MACHINE CODE FOR THE
6 REM FLIGHT SIMULATOR, S IS 32256, AND N IS 182.
7 REM
8 REM
10 DATA201,0,0,253,127,etc., or HEX. CODES.
20 DATA etc.
50 INPUT"STARTING ADDRESS DEC.";S:S=S-1
60 INPUT"NUMBER OF CODES, DEC.";N
70 FOR X=1 TO N:READ A:POKE(S+X),A:NEXT X
71 REM
72 REM FOR HEX., LINE 70 SHOULD BE: (REMOVE REM.)
73 REM FOR X=1 TO N:READ A$:POKE(S+X),VAL("&H" +H$):NEXT X
80 CLS:PRINT"CODES LOADED.  NOW SAVE IT AS A","MACHINE CODE FILE
 AND THEN","SAV
E THIS BASIC PROGRAM."
```

For subsequent loading and running, type

POKE25,6

enter New, enter and Cload the Basic from tape. Now type

CLEAR512,2943

and CLoadM the machine code from tape. Type Run enter and the machine will prompt you with "Start at address?"(decimal) which must be 3134 or above. Addresses 3134 to 32767 are now free for storage. You will now see a "S,L or C?" prompt, that is, search, load or clear. It is best to clear the memory before creating a new file, so respond "C" — this is error-trapped to avoid disasters. The program will stop, so rerun it and put the starting address in again. You can now put in text up to 255 characters using any character except asterisk and hash, which are reserved for program use. Each time you press Return, your entry is stored, and your position in memory is displayed. Press Break to leave this routine.

To search, rerun and answer 3134 to the address prompt, and S to the "S,L,C" prompt. You will now be asked for a string, maximum length 32 characters, and excluding asterisk or hash as before. The program will find the first entry, display all of it, not just the search word, and then ask "Cont?". Type Y to go on. You will see "Finished" when all the strings have been found.

(continued on page 135)

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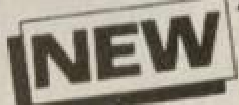
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(continued from page 133)

The file can be saved on tape, together with the machine-code program, by a CSaveM command. Your current position is contained in addresses 3092 and 3093, and can be found by typing:

PRINTPEEK(3092)*256 + PEEK(3093)

If the answer was 8000, you would then type:

CSAVEM"FILE",2943,8000,5058

for example. On reloading, the same Peek will tell you where to continue adding data to your file, that is, it will give you your starting address.

```
DECIMAL LISTING OF MACHINE CODE

2943  190  12   20   134  0    167  128  140  127  255
2953  38   249  57   206  0    101  198  0    31   155
2963  16   142  12   22   230  160  247  12   16   190
2973  12   20   166  128  177  12   16   39   7    140
2983  127  255  39   59   32   242  54   48   166  160
2993  183  12   18   129  35   39   13   166  128  177
3003  12   18   39   240  32   0    55   48   32   218
3013  55   48   191  12   20   166  130  16   142  4
3023  96   166  130  129  42   38   250  166  128  166
3033  128  129  42   39   8    129  32   39   8    167
3043  160  32   242  191  12   20   57   134  143  32
3053  244  16   190  12   14   190  12   20   198  0
3063  31   155  166  160  129  35   39   9    167  128
3073  140  127  255  39   2    32   241  191  12   20
3083  57   191  191  64   0    0    0    0    0    0
```

```
ASSEMBLER
LISTING FOR
STORE AND
SEARCH
00050          ORG    2943
00051 TEMP4    EQU    3092
00052 TEMP2    EQU    3090
00053 ENDP     EQU    $7FFF
00054 TEMP     EQU    3088
00055 TABLE    EQU    3094
00060 CSTART   LDX    TEMP4
00070          LDA    #$0
00080 CLEAR    STA    ,X+
00090          CMPX   #ENDP
00100          BNE    CLEAR
00110          RTS
00130 START    LDU    #$65
00131          LDB    #$00
00132          TFR    B,DP
00133          LDY    #TABLE
00140          LDB    ,Y+
00145          STB    TEMP
00150          LDX    TEMP4
00160 LOOP     LDA    ,X+
00170          CMPA   TEMP
00180          BEQ    SAME
00190          CMPX   #ENDP
00200          BEQ    DONEIT
00210          BRA    LOOP
00220 SAME     PSHU   Y,X
00230 CONT     LDA    ,Y+
00240          STA    TEMP2
00250          CMPA   #$23
00260          BEQ    OUT
00270          LDA    ,X+
00280          CMPA   TEMP2
00290          BEQ    CONT
```

(listing continued on page 137)

Arcade Action For The ZX Spectrum

SPECTRAVISION JOYSTICK £9.95 (arcade action, pistol grip, ATARI® Compatible)

Protek JOYSTICK INTERFACE

Protek JOYSTICK INTERFACE £14.95

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Edinburgh EH30 9HW
Tel. 031-331 4400

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(listing continued from page 135)

```
00300           BRA    BACK
00310 BACK      PULU   X,Y
00320           BRA    LOOP
00330 OUT       PULU   X,Y
00340           STX    TEMP4
00350           LDA    ,-X
00355           LDY    #$460
00356 SCHECK    LDA    ,-X
00357           CMPA   #$2A
00358           BNE    SCHECK
00359           LDA    ,X+
00360 PRINT     LDA    ,X+
00380           CMPA   #$2A
00390           BEQ    DONEIT
00391           CMPA   #$20
00392           BEQ    ADJUST
00400 RETADJ    STA    ,Y+
00410           BRA    PRINT
00420 DONEIT    STX    TEMP4
00430 DONE      RTS
00431 ADJUST    LDA    #$8F
00432           BRA    RETADJ
00441 VAR       EQU    3086
00443 MEMEND    EQU    $7FFF
00450 INST      LDY    VAR
00460           LDX    TEMP4
00465           LDB    #$0
00466           TFR    B,DP
00480 SLOOP     LDA    ,Y+
00490           CMPA   #$23
00500           BEQ    STDONE
00510           STA    ,X+
00520           CMPX   #MEMEND
00530           BEQ    STDONE
00540           BRA    SLOOP
00550 STDONE    STX    TEMP4
00560 STOPLO    RTS
00570           END
```

NB: You will probably have to assemble this program to a higher address, eg. ORG 6943 in line 50, and then move it down to start at 2943 before storing it on tape. This is because the Assembler may use the lower memory in the course of assembly.

Dragon Store and Search program.

```
20 INPUT "START AT ADDRESS";S:IFS<3134THEN20
25 POKE(3092),INT(S/256):POKE(3093),(S-(PEEK(3092)*256))
30 INPUT "S,L OR C";B$
40 IFB$="S" THEN 1000
45 IFB$="C" THEN 2000
90 POKE(S-1),42
95 CLS
100 LINE INPUT "TEXT:";A$
110 A$=A$+"*#"
120 A=VARPTR(A$)+2:B=VARPTR(A$)+3
130 POKE(3086),PEEK(A):POKE(3087),PEEK(B)
140 EXEC3054
150 P=PEEK(3092)*256+PEEK(3093)
155 CLS:PRINTP:IFP >=32766 THEN PRINT"FULL":POKE32767,42:END
156 GOTO100
1000 INPUT "SEARCH$";A$
1010 A$=A$+"#":IFLEN(A$))33THENPRINT"TOO LONG":GOTO1000
1011 FORN=1 TO LEN(A$)
1012 C=ASC(MID$(A$,N))
1013 POKE(3093+N),C
1014 NEXTN
1015 CLS
1020 EXEC2956
1030 IF PEEK(3092)*256+PEEK(3093))=32753 THEN PRINT @ 500,"FINI-
     SHED":END
1040 INPUT "CONT?";B$
1050 IF B$="Y" THEN 1015
1100 STOP
2000 INPUT"CERTAIN (Y)";B$
2010 IFB$="Y" THEN EXEC2943
2020 STOP
```

dk'tronics

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Our new cased keyboard has 52 keys, 12 of which are used for the numeric pad. The numeric pad offers useful features, you can cursor with one hand and it will be a boon for anyone who enters a lot of numeric data. The pad is a repeat of the 1 – 9 keys, it also has a full stop and a shift key. The numeric pad keys are red in colour, the normal keyboard keys are grey, with the case being black, which results in making the keyboard very attractive. The keyboard case dimensions are: 15" x 9" x 2½". The computer (either 80/81 or Spectrum), fits compactly inside.
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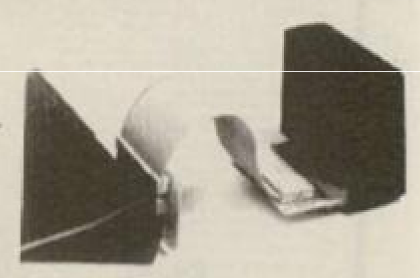
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This is the toolkit which won acclaim in the feature in the August 1982 issue of Sinclair User. "It is the most impressive programm, fast in execution with clear and full instructions . . . . it stands out from the rest of the field". The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER, AND VERIFY. The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K Spectrum.

4K GRAPHICS ROM £24.95

This module unlike most other accessories fits neatly inside your computer under the keyboard. The module come ready built fully tested and complete with a 4K graphic ROM. This will give you an unbelieveable number of extra pre-programmed graphics. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders, graphics and that only accounts for about 50 of them, there are still approximately 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

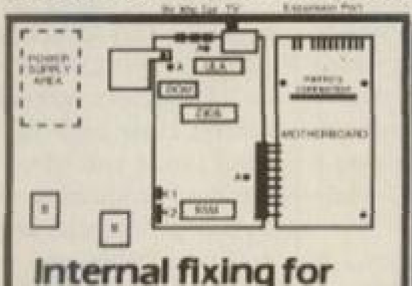
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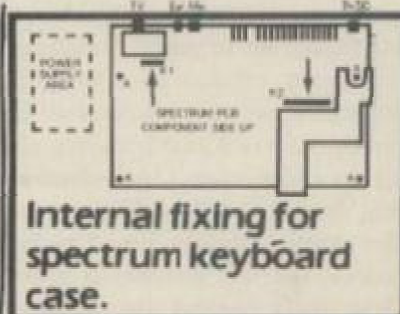
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LIGHT PEN
The pen enables you to produce high resolution drawings on your own T.V. screen. The controlling software supplied with the light pen has 16 pre-defined instructions. These are chosen from a menu positioned at the bottom of the screen next to the pen.
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The light pen is supplied with a control interface in order to adjust the sensitivity/pen alignment.
This simply plugs into the ear socket on your spectrum.
Should you require further details please send a S.A.E.



Internal fixing for ZX 81 keyboard case.



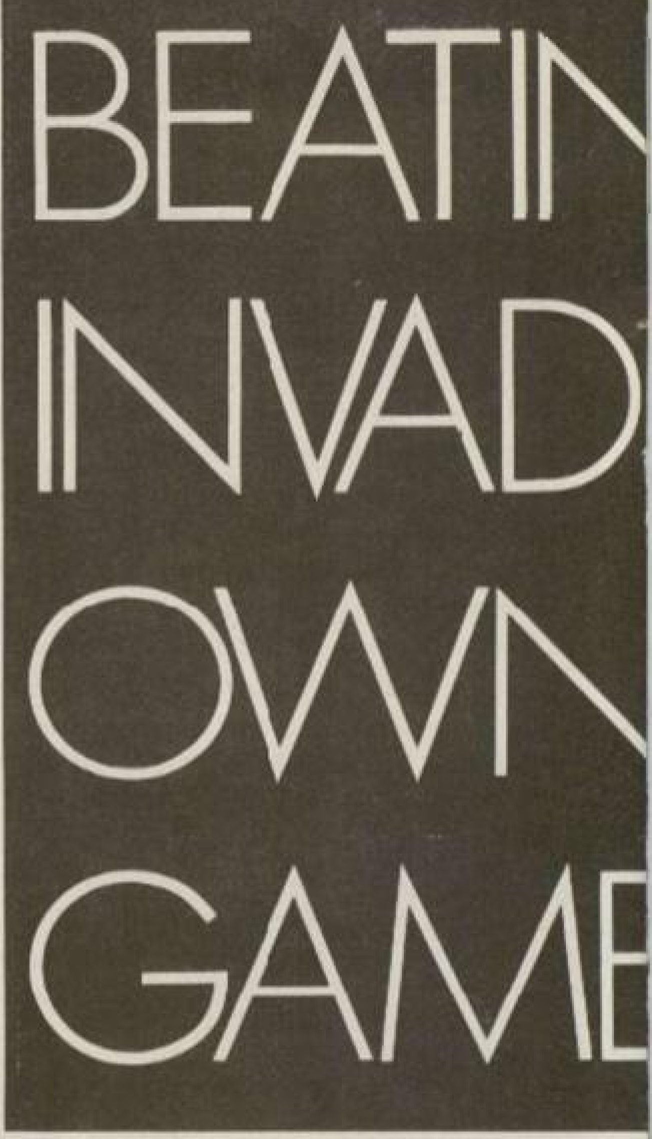
Internal fixing for spectrum keyboard case.

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Bagged a few aliens recently? Proud of it? Maybe games should encourage more thought. John Dawson lays down the sword and picks up the ploughshare.



I ONCE WROTE, a game for a programmable calculator called After your Lunar Module has Crashed.

The object of the game was to trek across the lunar surface in a solar-powered moon buggy, attempting to reach the safety of a home dome before the oxygen supply on the buggy ran out. The available oxygen was consumed at a constant rate throughout the journey but the initial battery charge for the buggy's motors was insufficient for the whole journey and, consequently, it was necessary to stop for a period to recharge the batteries from the buggy's solar cells.

Like the sand in one of Earth's deserts, the surface of the moon required little energy to travel at low speeds but a disproportionately large amount of energy if you attempted to push up the speed of the buggy in a mad dash for the home dome. The display on the calculator was limited in the first version to one line of figures and in a second to a single line of alpha-numeric characters. The game had to be played with the aid of graph paper on which was drawn a map of the area. The results from the calculator were plotted as compass bearings and co-ordinates for the buggy's position at the end of each stage of the journey.

That game was utterly different from Space Invaders or the other games of wholesale annihilation and destruction available for every home computer in town. The alien-preventing-burning-babies-from-being-munched-by-a-gorilla-with-a-large-hammer variety of games all depend upon fast graphics displays written in machine code against which the player has to exercise his or her physical skill and co-ordination in order to overcome the challenge set by the computer.

Both games are forms of modelling in which the computer establishes a limited universe within which events are simulated in order to test, in the case of Space Invaders, the player's ability to judge speeds and distances, while making the correct physical response.

After your Module has Crashed was a different kind of simulation involving no physical skills beyond the ability to input information to a calculator keyboard, but requiring the player to exercise judgement about a course of action that will lead to a desired goal.

An end to hostility

A third use of a computer in games playing is to limit the role of the machine to that of a referee, checking that moves made by two human opponents are legitimate and carrying out housekeeping functions such as the accumulation of scores and penalty points and the application of time limits to certain phases of the game.

There is quite a difference between playing a game and creating or developing your own program. As usual, the process begins with an idea. The idea may be to do with, literally, any activity or situation into which you can inject some human input. The preoccupation with violence and destruction evident in a very high proportion of computer games reflects only the poor, narrow minds of the people who wrote the original programs. Games are certainly competitive but it is possible to write an absorbing and challenging game that has peaceful, constructive aims.

Advice, for example, is a board game written by a doctor which models human social interactions. The game is for two players and each has a citizen, the most important of the persons represented on the board. The citizen is advised and protected, by a lawyer, a priest and a psychiatrist. The pieces are moved across the board with the aim of establishing the citizen in the home square of the opposing player. The lawyer can override the opposing psychiatrist but is subordinate to the spiritual force of the priest. The priest, in turn, may be overridden by the powerful medicine of the psychiatrist. The game is deceptively simple and complex strategies can be developed.

Constructive objectives

You could write a computer game about a mountain rescue team trying to evacuate a party of climbers in bad weather conditions; many of the current crop of small computers can draw excellent colour maps. If you want to inject a real-time graphics sequence into the game, why not model the difficult process of lowering a casualty down a cliff face in a stretcher using two ropes to stabilise the stretcher and a third climber to pick the best route. Only if you were successful in doing that would you be able to continue, making decisions about how to cross the swollen river in the valley floor.

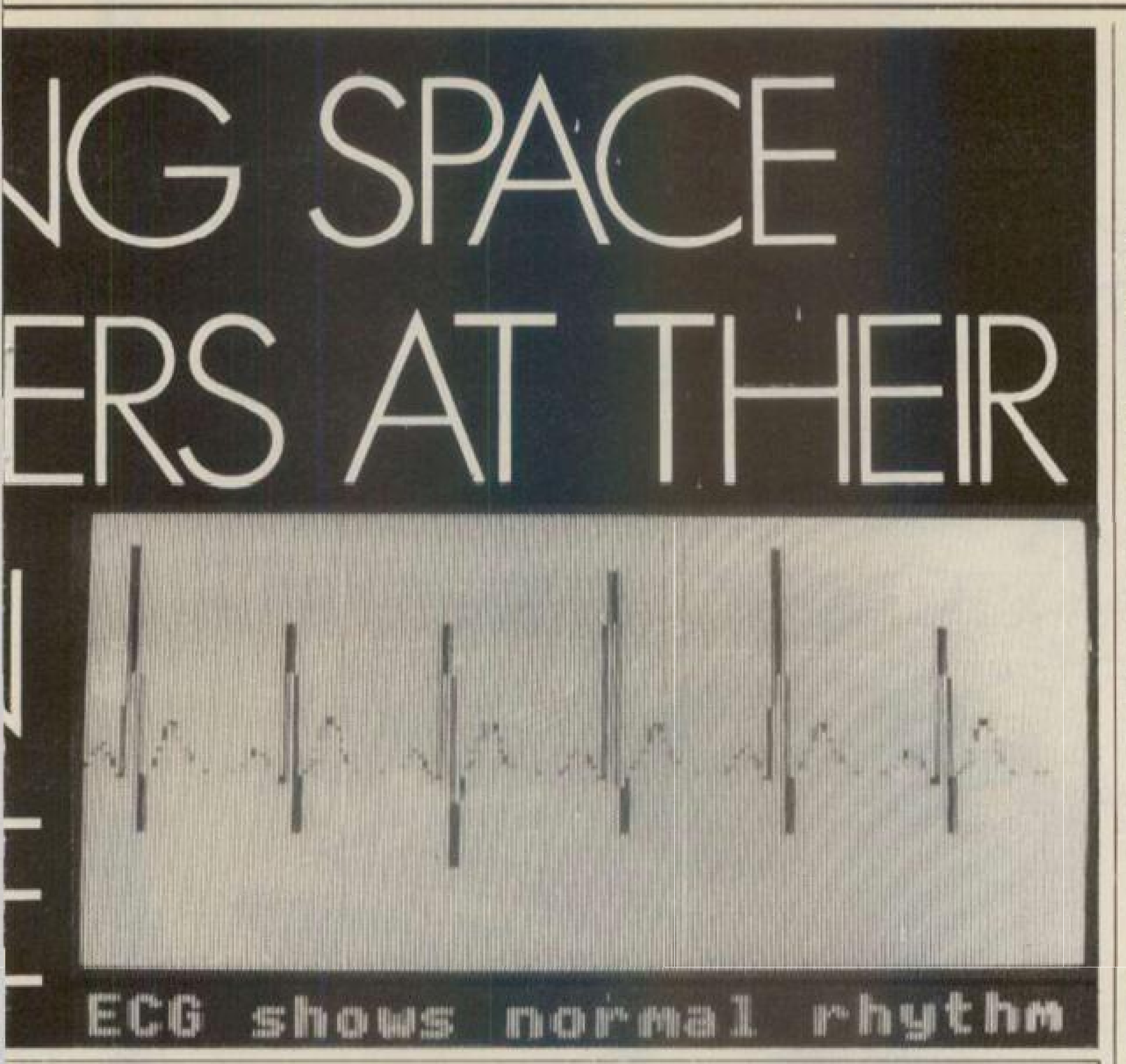
You could model the progress, against fierce opposition by local commerical interests, of a planning application for the redevelopment of an old factory site into a new community centre. How high is unemployment in your area? Could you set up a new business making fast food products, or high technology devices to help people who are disabled, or handmade craft souvenirs to sell at British holiday resorts, or writing software to run an irrigation scheme in a third world country?

Where would you site the business in a fictional town? How much money would you allow the players to start their business and what costs would accumulate before profits started to come into the business, what transport is available to bring workers to the place of work, or could they work at home and, if so, what management problems could you build into the game such as quality control and poor timekeeping?

The possibilities are endless. If you can find an activity that you can describe logically or using mathematical equations, then you have the basis for a computer model of the process and, hence, a game. One of the better games available for the Apple II and other computers is the simulation of the control cabin on a 747 Jumbo. One version is dreadfully slow but others are quite fascinating and do allow you to make mistakes and then recover before the aircraft crashes. Although you will probably use Basic if you decide to develop your own game, other languages may be more suitable for the particular type of game that you wish to create.

```
*LIST
 10
 20 REM "HEARTSTOP"
 30 REM Started 12 June 1983
 40 REM A game by John Dawson
 50
 60 PROCinit
 70 MODE 4
 80 REM MAIN COMMAND LOOP
 90 REPEAT
100    comm = INKEY(10)
110    IF comm = -1 THEN
       PROChousekeeper
120    comm$ = CHR$(comm)
130    IF comm$ = "E" THEN PROCecg
140    UNTIL comm$ = "Q"
150 MODE 7
160 END
170
180 DEF PROChousekeeper
190 ENDPROC
200
```

Forth is a typical example of a high-level language which can, nevertheless, be used to produce very fast machine-code graphics routines. Lisp is a functional list-processing language which can be well suited to games involving "artificial intelligence" or games in which the performance of the machine is modified by the results that it achieves as each round is played. In other words, it is easier to write a program in Lisp that will allow the machine to learn from its mistakes and




```
210 DEF PROCecg
220 VDU 5
230 VDU 19,0,0,0,0,0
240 VDU 19,1,2,0,0,0
250 MOVE 500,1000 : MOVE
    1250,1000
260 PLOT 85,500,660
270 PLOT 85,1250,660
280 MOVE 500,800
290
300 PROCecgplot
310 MOVE 500,600
320 PRINT "ECG shows ";res$
330 ENDPROC
340
350 DEF PROCinit
360 DIM Y(30)
370 ON ERROR GOTO 570
380 ENDPROC
390
400 DEF PROCecgplot
410 res$ = "normal rhythm"
420 size = 15
430 LOCAL  X,Y,xpos,ybaseline
440 xpcs = 500
450 ybaseline = 800
460 REFEAT
470   FOR X = 1 TO 120 STEP 5
480     READ Y
490     PLOT 6,(xpos+X),(ybase
        line + (size * (Y)))
500     NEXT X
510   xpos = xpos+X
520   RESTORE
530   LNTIL xpos > 1150
540 DATA 0,0.7,1.4,1.1,0,0,-1,
    16,-6,0,0,1,1.5,3,2,1.5,
    0.5,0,0,0,0,0,0,0,0
550 ENDPROC
560
570 MODE 7
580 REPORT
590 PRINT ERL
600 END
```

successes than it is to do the same job in Basic.

Several articles have been published about the use of Prolog — programming with logic — for the development of games to teach history.

Dialectical history

The programmer who designed the games developed a structured collection of information which can be interrogated in particular ways to give information, for example, about the progress of the Russian revolution; allowing the players to develop different policy options

I am becoming something of a fanatic about the BBC Micro computer. The Basic interpreter supplied with the machine is extremely fast and the provision of procedures and the Repeat . . . Until structure makes programs easy to develop and understand. The Basic is so fast that for many purposes it is unnecessary to use the built-in assembler.

Listing 1 shows the first few lines of a game that I have started to write called Heartstop. The player is put in the role of a junior hospital doctor and the purpose of the game is to treat a patient in a hospital Intensive Care Unit while coping with a lot of distracting pressures. I wrote this part of the program first because I wanted to see if I could display an ECG recording in the course of the game. An ECG is an Electro-cardiograph, which

IDEAS

means that it shows the electrical activity of the heart muscle. Different patterns of activity can be isolated in abnormal conditions affecting a person's heart and interpretation of both simple and complex ECGs can play a major part in treating heart attacks.

After the first introductory lines the program calls a procedure — 60 Procinit. Procedures are defined parts of a program — program modules — that carry out a particular function. You should be able to write a number of procedures that operate independently of each other by using local variables. Results from the procedure can be transmitted by global variables for use by the rest of the program. This method of constructing a program makes it easy to read and understand and even makes it possible for more than one person to work on the program with some hope that the various bits will match up at the end without producing endless bugs.

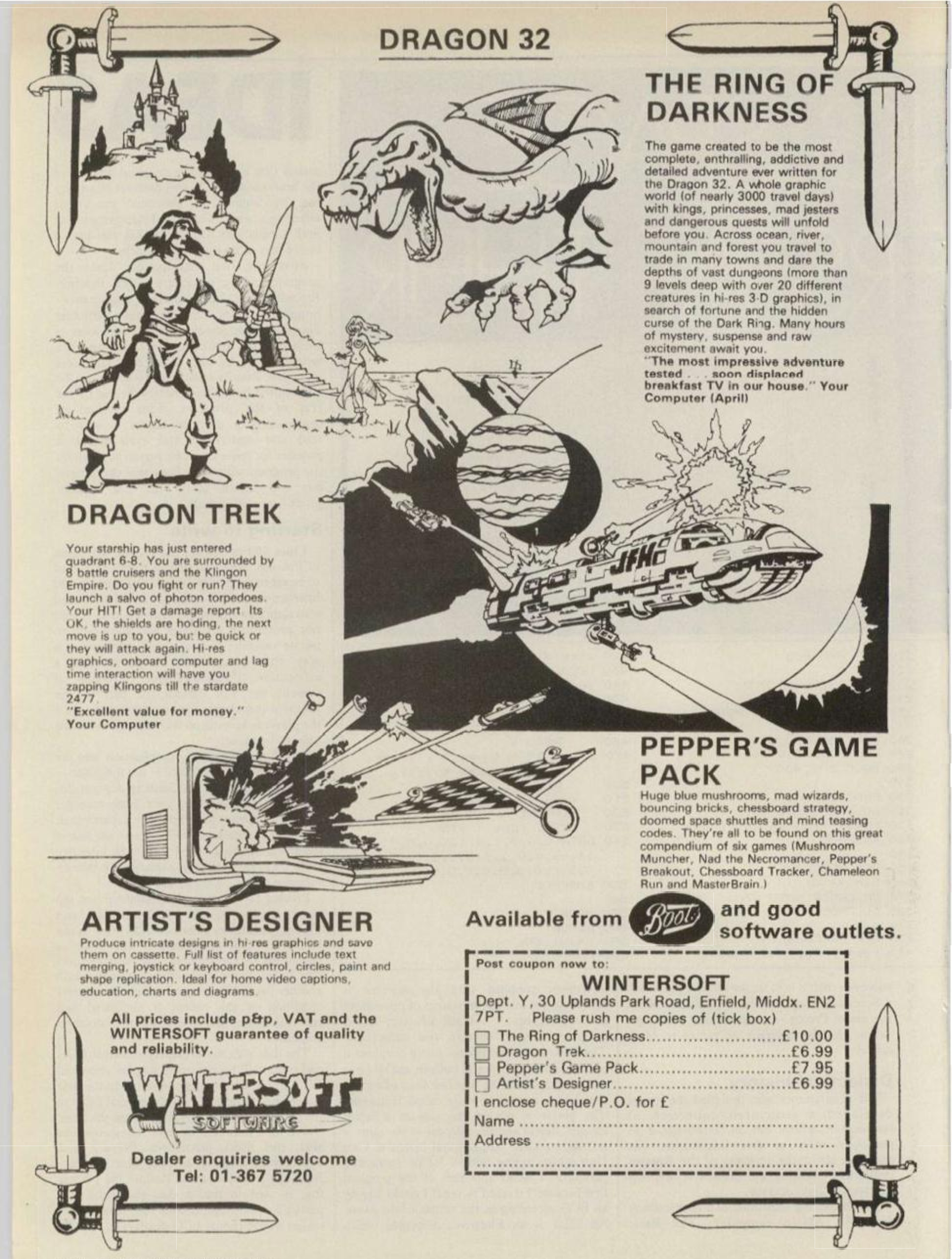
Starting to write

Lines 350 to 380 are the present definition of Procinit. As I find further things that need to be set to particular values I shall simply add instructions to that section. I could have used a straightforward Gosub instruction at line 60 but procedures are faster and allow you to isolate variables from the main program in a way that you cannot achieve with a subroutine. Prochousekeeper is empty at present but will contain the part of the program that checks the time variable to see if the player is keeping up with the decisions that have to be made.

It will also introduce complication into the game by bleeping the doctor — you the player — with messages from the Casualty department, the Unit administrator, your bank manager and the Pharmacy and Pathology departments. Ignoring the messages will increase the risk of disaster overtaking the patient in the Intensive Care Unit, answering the message will take up valuable time — just like real life.

Procecg sets up a green rectangle in the top right corner of the BBC display and Procecgplot draws a normal ECG trace in the rectangle. The amplitude of the trace is controlled by the variable 'size' and I expect that I shall move it out of the procedure into another part of the program where the general condition of the patient is simulated and controlled on the basis of the doctor's responses.

The data statements display a normal ECG and more will be needed to display abnormal ECG traces. Comparing the values in the data statement in line 540 with the normal ECG in the picure you should be able to turn the other traces into numbers in data statements and alter the main procedures Procecg and Procecgplot to show irregular heart activity. BBC Basic allows you to Restore the pointer that is used to read a data statement to a particular line number and that may be the easiest way to choose ECG displays. ■



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INTERPRETATION

6502 MACHINE CODE

Darryl Mattocks continues his guide to 6502 machine code.

AS SHAKESPEARE might have said if he were around today, "All the world's an interpreter, and the people in it just Basic sub-routines". When Basic comes across a command such as Print, or Input, these keywords set off a veritable flood of machine code sub-routines which are contained in the Basic Rom.

A small section of the whole interpreter is shown in figure 1, but hopefully you can see the manner in which Basic works — get an instruction, decode it, execute the appropriate subroutines, get the next instruction. The process is essentially the same in any high level interpreter such as Forth, Pascal, Fortran, Cobol and so on.

Command combinations

When the interpreter comes across a command such as

'PRINT A'

it might say . . .

Is it a 'PRINT' command?
Is it a 'PRINT". . ."' command?
Is it a 'PRINT:' command?
IS it a 'PRINT value' command?
Look up the value in the variable list
Convert it into a printable form
Print out the characters from the current cursor location
Has a scroll or new line been incurred?
Is the command followed by a semi-colon?

There are a large number of possible combinations for the Print command on its own, and the number of comparisons made by the processor in deciding what type of print command it has is enormous.

Why not scrap all of the decoding, and call the various subroutines as and when they are needed? A program which does this is called a compiler.

The internal workings of a compiler are quite complex, but using one is simplicity itself. Assume that you have written a completely bug-free Basic program, you can then run a compiler which will take all of your Basic program and convert it into the same program, but in machine code.

Sounds too good to be true? It is. Unfortunately, the machine code it generates is very inefficient. The compiler has cut out most of the irrelevances, but not all. Although the program is in machine code, it is only up to 40 times faster than Basic. That is the sort of thing you might read in adverts, a more realistic figure is that of an increase to about 15 times the speed of Basic.

Compilers are certainly worth looking at for the home user, but being only 15 times faster, they are still not up to the speeds of pure machine code.

There are seven flags in the status register and one of them is the decimal flag. Unlike others such as carry, it does not form the

(continued on page 145)

```
10 REM ***COUNTING PROGRAM FOR THE CBM 64
20 READD$:IFD$="*"THEN60
30 D1$=LEFT$(D$,1):D2$=RIGHT$(D$,1)
40 V=(ASC(D1$)-48+((ASC(D1$)>64)*7))*16
45 V=V+(ASC(D2$)-48+((ASC(D2$)>64)*7))
50 POKE2*4096+C,V:C=C+1:GOTO20
60 SYS8197:END
100 DATA 00,00,00,00,00,20,14,20,20,28,20
105 DATA 20,3B,20,20,67,20,4C,0B,20
110 DATA A2,00,A9,20,9D,00,04,9D,00,05,9D
115 DATA 00,06,9D,E7,06,CA,D0,F1,60
120 DATA A2,00,8D,20,D0,8D,21,D0,A9,01,A2
125 DATA 0A,9D,D9,04,CA,D0,FA,60
130 DATA F8,18,AD,00,20,69,01,8D,00,20,AD
135 DATA 01,20,69,00,8D,01,20,AD,02,20
140 DATA 69,00,8D,02,20,AD,03,20,69,00,8D
145 DATA 03,30,AD,04,20,69,00,8D,04,20
150 DATA D8,60,18
160 DATA AD,00,20,29,0F,69,30,8D,E3,04,AD
165 DATA 00,20,4A,4A,4A,4A,69,30,8D,E2,04
170 DATA AD,01,20,29,0F,69,30,8D,E1,04,AD
175 DATA 01,20,4A,4A,4A,4A,69,30,8D,E0,04
180 DATA AD,02,20,29,0F,69,30,8D,DF,04,AD
185 DATA 02,20,4A,4A,4A,4A,69,30,8D,DE,04
190 DATA AD,03,20,29,0F,69,30,8D,DD,04,AD
195 DATA 03,20,4A,4A,4A,4A,69,30,8D,DC,04
200 DATA AD,04,20,29,0F,69,30,8D,DB,04,AD
205 DATA 04,20,4A,4A,4A,4A,69,30,8D,DA,04
,60,*
```

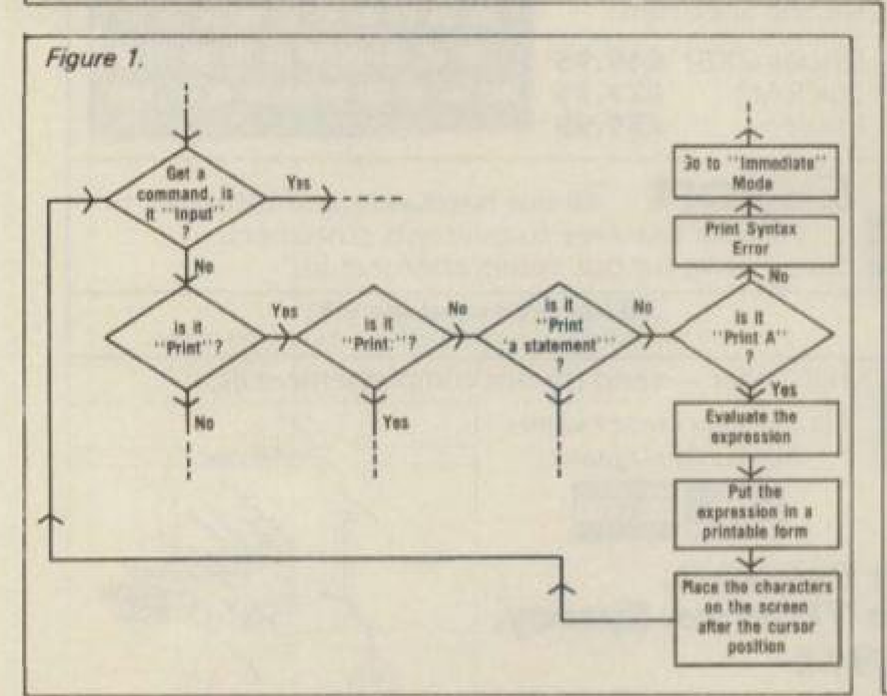


Figure 1.

continued from page 143)
basis of many branches or jumps, but changes the whole operation of the 6502 processor.

Normally, we think of the computer as a binary system, with all numbers and other references appearing as multiples of two. Not when the decimal flag is set.

The same binary system operates but now instead of binary representation, a system known as Binary Coded Decimal — BCD — is used.

BCD has two features which distinguish it from the normal binary code. The first is that a byte ceases to be considered as one whole byte — eight bits — but is now just a useful way of manoeuvering two nibbles — four bits. The second feature is that numbers are now represented literally, for example:

0100 decimal = 0000 0001 0000 0000 BCD
0527 decimal = 0000 0101 0010 0111 BCD
9479 decimal = 1001 0100 0111 1001 BCD

To code something into BCD all we have to do is to give each of the digits in the decimal number their corresponding binary code and string all of these four-bit codes together.

BCD representation

Adding up in BCD is somewhat easier to master. As the maximum value of any nibble is ten, the maximum value of any byte is 99 and any addition which results in a number larger than 99 sets the carry flag. All of this makes working with BCD representation much the same as ordinary addition.

Before we have a look at BCD in operation, there is one disadvantage. Any code which uses the carry flag as a counter for anything in binary will not work at all well when the decimal flag is set. To overcome this minor setback, only set the decimal flag when the actual addition or subtraction is taking place, turn it off immediately afterwards.

Program 1 illustrates adding up in the decimal mode. Try to put the great decimal mode into action with a counting program. The program will clear the screen, colour it black and then start counting from one to one million million. Playing around, I calculated that the machine-code program takes approx seven hours to count up to 1,000,000,000,000 whereas the basic equivalent takes about two weeks. The Basic program to enter the machine code is given after the assembler listing.

COMMODORE 64

```
LINE# LOC   CODE       LINE

      0000             ;         PUT "@:COUNT.SRC"
      0000             ;
      0000             ;FOR THE CBM 64
      0000             ;
      0000             ;WILL COUNT UP TO 9 999 999 999
      0000             ;AND THEN RESET AND START AGAIN.
      0000             ;
      0000                       * = $2000
      2000             ;
      2000             ;
      2000  00         VAL1    .BYT 0          ;UNITS+TEN
      2001  00         VAL2    .BYT 0          ;HUNDREDS+THAUSANDS
      2002  06         VAL3    .BYT 0          ;ETC
      2003  00         VAL4    .BYT 0
      2004  00         VAL5    .BYT 0
      2005             ;
      2005             ;
      2005             ;
      2005  20 14 20   START   JSR CLEAR       ;CLEAR SCREEN
      2008  20 28 20           JSR COLOUR      ;COLOUR BYTES
      200B             ;
      200B  20 3B 20   MAIN    JSR PLUS1       ;ADD ONE
      200E  20 67 20           JSR DISP        ;DISPLAY
      2011  4C 0B 20           JMP MAIN        ;DO IT AGAIN
      2014             ;
      2014  A2 FF      CLEAR   LDX #255        ;STORE SPACES
      2016  A9 20              LDA #32         ;OVER SCREEN
      2018  9D 00 04   CLR1    STA $0400,X
      201B  9D 00 05           STA $0500,X
      201E  9D 00 06           STA $0600,X
      2021  9D E7 06           STA $06E7,X
      2024  CA                 DEX
      2025  D0 F1              BNE CLR1
      2027  60                 RTS
      2028             ;
      2028             ;
      2028  A2 00      COLOUR LDX #0           ;COLOUR IS BLACK
      202A  8D 20 D0           STA 53280       ;BORDER COLOUR
      202D  8D 21 D0           STA 53281       ;SCREEN COLOUR
      2030  A9 01              LDA #1
      2032  A2 0C              LDX #12         ;NUMBERS WHITE
      2034  9D D9 04   COL1    STA 1024+217,X
      2037  CA                 DEX
      2038  D0 FA              BNE COL1
      203A  60                 RTS
      203B             ;
      203B             ;
      203B  F8         PLUS1   SED             ;DECIMAL ON
      203C  18                 CLC
      203D             ;
      203D  AD 00 20           LDA VAL1        ;ADD 1 TO UNITS
      2040  69 01              ADC #1
      2042  8D 00 20           STA VAL1
      2045             ;
      2045  AD 01 20           LDA VAL2        ;CARRY FROM THE
      2048  69 00              ADC #0          ;TENS NIBBLE ?
      204A  8D 01 20           STA VAL2
      204D             ;
      204D  AD 02 20           LDA VAL3        ;CARRY FROM THE
      2050  69 00              ADC #0          ;THAUSANDS
      2052  8D 02 20           STA VAL3        ;NIBBLE
      2055             ;
      2055  AD 03 20           LDA VAL4        ;HUNDRED
      2058  69 00              ADC #0          ;THAUSANDS ?
      205A  8D 03 20           STA VAL4
      205D             ;
      205D  AD 04 20           LDA VAL5        ;ETC
      2060  69 00              ADC #0
      2062  8D 04 20           STA VAL5
      2065             ;
      2065  D8                 CLD
      2066  60                 RTS
      2067             ;
      2067             ;
      2067             ;
      2067  18         DISP    CLC
      2068             ;
      2068  AD 00 20           LDA VAL1        ;UNIT
      206B  29 0F              AND #%00001111  ;NIBBLE
      206D  69 30              ADC #48
      206F  8D E3 04           STA 1024+227
      2072  AD 00 20           LDA VAL1        ;TENS
      2075  4A                 LSR A           ;NIBBLE
      2076  4A                 LSR A
      2077  4A                 LSR A
      2078  4A                 LSR A
      2079  69 30              ADC #48
      207B  8D E2 04           STA 1024+226
      207E             ;
      207E  AD 01 20           LDA VAL2        ;HUNDREDS
      2081  29 0F              AND #%00001111  ;NIBBLE
      2083  69 30              ADC #48
      2085  8D E1 04           STA 1024+225
      2088  AD 01 20           LDA VAL2        ;ETC
      208B  4A                 LSR A
      208C  4A                 LSR A
      208D  4A                 LSR A
      208E  4A                 LSR A
      208F  69 30              ADC #48
      2091  8D E0 04           STA 1024+224
      2094             ;
      2094  AD 02 20           LDA VAL3
      2097  29 0F              AND #%00001111
      2099  69 30              ADC #48
      209B  8D DF 04           STA 1024+223
      209E  AD 02 20           LDA VAL3
      20A1  4A                 LSR A
      20A2  4A                 LSR A
      20A3  4A                 LSR A
      20A4  4A                 LSR A
      20A5  69 30              ADC #48
      20A7  8D DE 04           STA 1024+222
      20AA             ;
      20AA  AD 03 20           LDA VAL4
      20AD  29 0F              AND #%00001111
      20AF  69 30              ADC #48
      20B1  8D DD 04           STA 1024+221
      20B4  AD 03 20           LDA VAL4
      20B7  4A                 LSR A
      20B8  4A                 LSR A
      20B9  4A                 LSR A
      20BA  4A                 LSR A
      20BB  69 30              ADC #48
      20BD  8D DC 04           STA 1024+220
      20C0             ;
      20C0  AD 04 20           LDA VAL5
      20C3  29 0F              AND #%00001111
      20C5  69 30              ADC #48
      20C7  8D DB 04           STA 1024+219
      20CA  AD 04 20           LDA VAL5
      20CD  4A                 LSR A
      20CE  4A                 LSR A
      20CF  4A                 LSR A
      20D0  4A                 LSR A
      20D1  69 30              ADC #48
      20D3  8D DA 04           STA 1024+218
      20D6             ;
      20D6  60                 RTS
      20D7             ;
      20D7             ;
      20D7             ;
      20D7                     .END

ERRORS = 00000

SYMBOL TABLE

SYMBOL VALUE
 CLEAR    2014   CLR1     2018   COL1     2034   COLOUR   2028
 DISP     2067   MAIN     200B   PLUS1    203B   START    2005
 VAL1     2000   VAL2     2001   VAL3     2002   VAL4     2003
 VAL5     2004

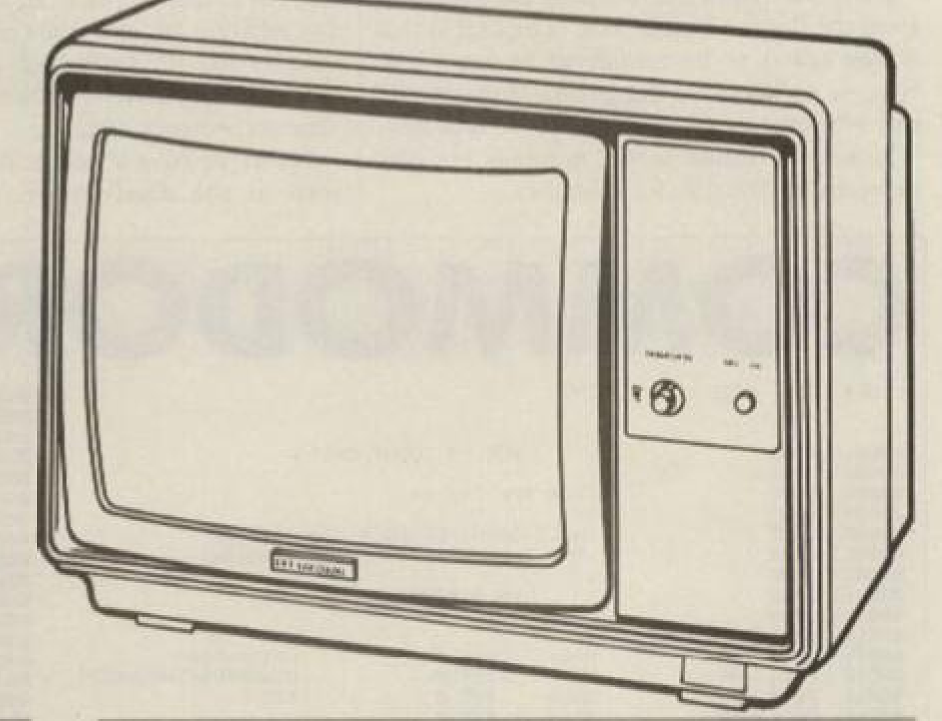
END OF ASSEMBLY
```

(continued on page 147)

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(continued from page 145)

```
LINE# LOC   CODE        LINE

      0000              ;       PUT  "@:BCD ADD.SRC"
      0000              ;
      0000              ;THIS PROGRAM RUNS ON A CBM 64.
      0000              ;
      0000              ;THE ACTUAL ADDING UP IS MUCH THE
      0000              ;SAME AS IN THE NORMAL,BINARY.MODE
      0000              ;THE MAIN DIFFERENCE IS THAT NOW
      0000              ;THE VALUE IN THE HI-BYTES
      0000              ;REPRESENT MULTIPLES OF 100 OF THE
      0000              ;LO-BYTES INSTEAD OF 256 TIMES.
      0000              ;
      0000              ;
      0000              ;TO ADD THE NUMBER STORED IN NUMLO
      0000              ;AND NUMHI TO THE NUMBER CONTAINED
      0000              ;IN THE ANSLO AND ANSHI PAIR.
      0000              ;
      0000              ;
      0000              ;
      0000                      * = $2000
      2000              ;
      2000  34          NUMLO  .BYT $34
      2001  07          NUMHI  .BYT $07          ;= 0734 DECIMAL
      2002              ;
      2002  28          ANSLO  .BYT $28
      2003  09          ANSHI  .BYT $09          ;= 0928 DECIMAL
      2004              ;
      2004              ;
      2004  F8          START  SED               ;DECIMAL MODE ON
      2005  18                 CLC
      2006  AD 02 20           LDA ANSLO         ;ADD THE
      2009  6D 00 20           ADC NUMLO         ;LO-BYTES
      200C  8D 02 20           STA ANSLO
      200F              ;
      200F  AD 03 20           LDA ANSHI         ;AND THE
      2012  6D 01 20           ADC NUMHI         ;HI-BYTES
      2015  8D 03 20           STA ANSHI
      2018              ;
      2018              ;ANSWER IS IN ANSLO AND ANSHI
      2018              ;
      2018  D8                 CLD               ;DECIMAL MODE OFF
      2019  60                 RTS               ;RETURN  TO BASIC
      201A              ;
      201A                     .END

ERRORS = 00000
```

```
SYMBOL TABLE

SYMBOL VALUE
 ANSHI    2003   ANSLO    2002   NUMHI    2001   NUMLO    2000
 START    2004

END OF ASSEMBLY

2 REM FOR THE CBM 64
3 REM ***SET SCREEN COLOURS
5 POKE53280,0:POKE53281,0:PRINT"[CLR]"
10 REM ***POKE IN MACHINE CODE
20 READD$:IFD$="*"THEN200
30 D1$=LEFT$(D$,1):D2$=RIGHT$(D$,1)
40 V=(ASC(D1$)-48+((ASC(D1$)>64)*7))*16+(ASC(D2$)-48+((ASC(D2$)>64)*7))
50 POKE2*4096+C,V:C=C+1:GOTO20
60 REM ***MACHINE CODE DATA
100 DATA 34,07,28,09,F8,18,AD,02,20,6D,00,20,8D,02,20
110 DATA AD,03,20,6D,01,20,8D,03,20,D8,60,*
120 REM ***CONVERTS INPUTED DATA TO BCD
130 REM ***FIRST NUMBER TO BE ADDED
200 PRINT"[CLR]FIRST NUMBER"
201 PRINT"  UNITS";:GOSUB400:POKE2*4096,A
210 PRINT"  TENS";:GOSUB400:POKE2*4096,PEEK(2*4096)+A*16
220 PRINT"  HUNDREDS";:GOSUB400:POKE2*4096+1,A
230 PRINT"  THOUSANDS";:GOSUB400:POKE2*4096+1,PEEK(2*4096+1)+A*16
235 PRINT
236 REM ***SECOND NUMBER
240 PRINT"SECOND NUMBER"
241 PRINT"  UNITS";:GOSUB400:POKE2*4096+2,A
250 PRINT"  TENS";:GOSUB400:POKE2*4096+2,PEEK(2*4096+2)+A*16
260 PRINT"  HUNDREDS";:GOSUB400:POKE2*4096+3,A
270 PRINT"  THOUSANDS";:GOSUB400:POKE2*4096+3,PEEK(2*4096+3)+A*16
280 SYS 2*4096+4
290 PRINT
295 REM ***ANSWER IN BCD TO DECIMAL
300 PRINT"ANSWER IS"
301 PRINT"  UNITS";PEEK(2*4096+2) AND 15
310 PRINT"  TENS";(PEEK(2*4096+2)/16) AND 15
320 PRINT"  HUNDREDS";PEEK(2*4096+3) AND 15
330 PRINT"  THOUSANDS";(PEEK(2*4096+3)/16) AND 15
340 PRINT"[DOWN][DOWN][DOWN]RUN AGAIN ,1 FOR YES, 9 FOR NO":GOSUB400:IFA<>9THENRUN200
350 END
399 REM ***SELECTIVE INPUT ROUTINE
400 GETA$:IFA$=""THEN400
410 IFASC(A$)<48 OR ASC(A$)>57THEN400
420 A=VAL(A$):PRINTA:RETURN

READY.
```

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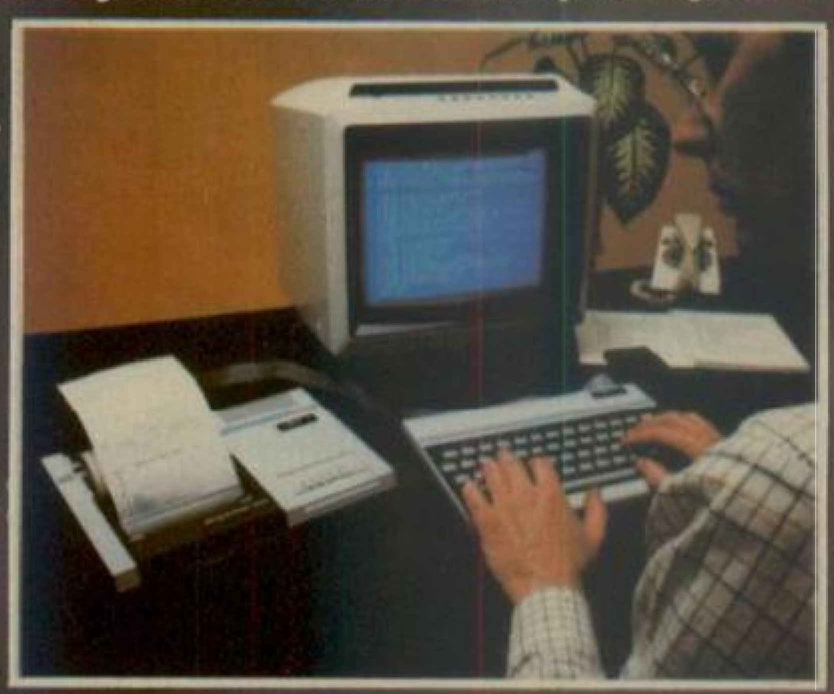
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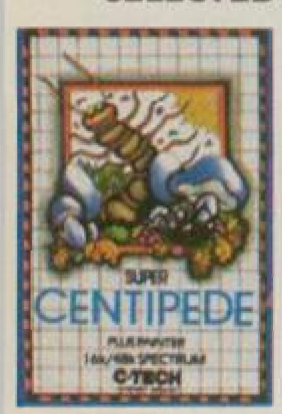
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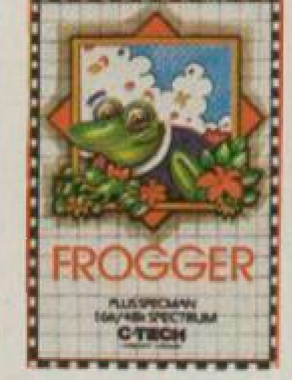


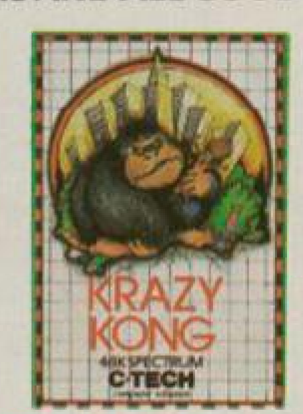
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I have read in American computing magazines about summer camps which concentrate on computer use. Is there anything like that in the U.K.?

Malcolm Parks,
Amersham.

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ANAGRAM

I am the owner of a 48K Spectrum and have been trying unsuccessfully to write a program for working out anagrams, that is to print out a seven-letter word and every combination of the seven letters on the screen. I would be most grateful if you could help.

G Smith,
Tyne and Wear.

ONE WAY to tackle this would be to use the Sinclair's string-slicing facilities to break the word down into seven separate characters, and take the code of each and place these in elements of an array. Then you could use the random number generator to randomly mix the elements of the array, finally printing out the word using CHR$. You will need two loops, one inside the other, to ensure that each element of the array is only used once in each anagram.

ORIC QUERY

I have owned a ZX-81 for about a year now and recently decided to buy an Oric 1. On going to shops such as Dixons and WH Smith to buy directly rather than by mail order, I was told that the stores only stocked the 48K model. Wanting a 16K rather than a 48K version I was rather disappointed. On further enquiry at one shop I was told if I ordered a 16K version by mail I would be sent a 48K machine and asked to pay the difference. Is this true? Do I have to buy a 48K machine?

T Zahoui,
Shoreham.

ORIC'S PR company, in rather guarded replies to my queries, said "most of the 16K production has gone to Europe but Tangerine is selling a few by mail order". At present, if you order a 16K by mail order, you may be sent a 48K Oric "on loan", with the idea that when the 16K becomes available you will be given the option of swapping your 48K for the 16K, or of paying the difference. When I bought an Oric by phone when they were first advertised last October, I ordered the 16K, but received a 48K, my credit card was debited for a 48K machine, and no "downgrade option" was offered. Oric assure me this was a mistake. Ian Osborn of Norfolk wrote to ask if it was possible to buy a 16K model now, with the idea of buying an upgrade kit to make his Oric 48K in due course. Oric's PR company says that "no expansion is possible for the Oric".

DISABLED HELP

My 14-year-old son is disabled, but wants very much to be able to use a computer. Our local computer shop has been most sympathetic and has tried to help, but have been unable to make any specific suggestions on how we can equip a microcomputer so that my son can use it. Is there a resource centre we can turn to?

Mrs K Jones,
Edinburgh.

UNFORTUNATELY, you do not mention the natures of your son's disability, which limits somewhat the advice I can give. I have heard from a number of people over the past two years with disabilities — generally involving limited movement and control skills — who have managed to find satisfactory ways of operating their computers. Electriad, New Street, Aylesbury (0296) 87309 should be able to assist you, particularly in respect of use of Commodore computers such as the Vic-20.

You may also like to contact the Disabled Advice Service, Atheldene Community Centre, Garratt Lane, London, SW18, 01-870 7437, and the Disabled Living Foundation, 346 Kensington High Street, London W14, 01-602 2491. Contact a Family is a organisation which links up parents throughout the U.K. who have a handicapped child living with them at home. One of the fathers associated with the organisation is a computer buff who has set up a scheme called CAFCAL — Contact a Family Computer Assisted Learning. The scheme is based around the Vic-20 and is building up a library of suitable programs. You can contact the group at 16 Strutton Ground, Victoria, London, SW1 P2HP 01-222 2695. CAFCAL welcomes suitable educational programs from any Vic-20 users.

TEXAS PRINTER

I have recently bought a Texas Instruments TI-99/4A computer and I want to connect a printer to it. I have been told by one shop that although there is a Texas printer, it is not yet available in the U.K. Is this true, and if so, what printer can I buy which is suitable for my computer?

Scott Shaw,
Hounslow.

CONNECTING a printer to the TI-99/4A is a rather involved and expensive process. The official TI printer retails for £481 but is not currently available in the U.K. Before you can connect any printer, including the Texas one, to the computer you need to buy a peripheral expansion box for £159 and the TI RS-232 interface which costs £117. Once you have these, any printer which connects with an RS-232 interface will work, such as the dot matrix printers made by Epson — these start around £400. Texas peripherals are available by mail from Landau Electronics, Lion House, 227 Tottenham Court Road, London, WC2. You can check on availability by phoning them on 01-580 7383, extension 28. Texas tells me that a range of cheaper peripherals will be available "real soon". These are designed for the TI pocket computer, the CC-40. An adaptor will be available to connect these to the TI-99/4A.

FAST DEFENDER

I have written a simple Defender program on my ZX-81. However, it runs too slowly to be much of a game. How can I speed it up?

Andrew Marsden,
London W4.

THE SHORTEST, and best answer, would be to learn machine code, and then rewrite the program in machine code, rather than Basic. However, this is not an easy task although it is a skill you should seriously consider acquiring. The way in which your Basic program is written; that is, the order of the lines, and the things you get your computer to do, such as raising numbers to a power, or making decisions all have an effect on the running speed of the program. Try to write it so you make as few decisions as possible. Generate as few random numbers as possible — you may be able to generate just one random number each time the program cycles, and use this in different places. Try to make the program run in a clear loop, with a single Goto at the end of the major loop. An alternative to a Goto is a vast For-Next loop which contains a much higher number than you are likely to need — such as For A = 1 to 100,000. Finally, make the first line of your program Poke 16389,75 to slightly speed the computer up.

NEED TO KNOW

I have had my BBC Micro for five weeks now, and have bought some commercial software for it. The quality of the tapes I've bought is very high, but I find the programs most depressing. Why? simply because my puny efforts at programming seem so weak when compared to the effects possible from accomplished programmers. What is the best way to improve my programming quickly? I should add that the BBC is the first computer I have ever had, and I am barely past the For-Next loop stage of Basic programming.

Colin Chelnton,
Southampton.

THE OLD ADAGE about learning to walk before you try to run holds true for programming. The learning curve for Basic is fairly steep at the beginning, but soon evens out to a very gradual rise. You sound as if you are past the worst already. The three best ways to improve your programming are to get in touch with a local users' group, join one of the national user clubs, and read some books on the subject. An advertisement in your local newspaper, or a notice in a computer shop — such as your nearest BBC Micro dealers — should uncover other users in your area. The two national clubs are Laserbug, 10 Dawley Ride; Colnebrook, Slough, Berkshire, SL3 0QH, Beebug, 374 Wandsworth Road, London SW8 4TE. There are many, many books for the BBC Micro. One of the latest is *The BBC Micro Book — Basic, Sound and Graphics* by McGregor and Watt, published by Addison-Wesley. Others include *APL for the BBC Micro, The BBC Micro, An Expert Guide, Instant BBC Micro Machine Code, The BBC Micro Revealed, Easy Programming for your BBC Micro, The BBC Micro Compendium, Games BBC Computers Play, The Book of Listings, Let your BBC Micro Teach You to Program, Practical Programs for the BBC Computer and Acorn Atom, 30+ Programs for the BBC Micro,* and *30 Hour Basic.* ■

MAKERS

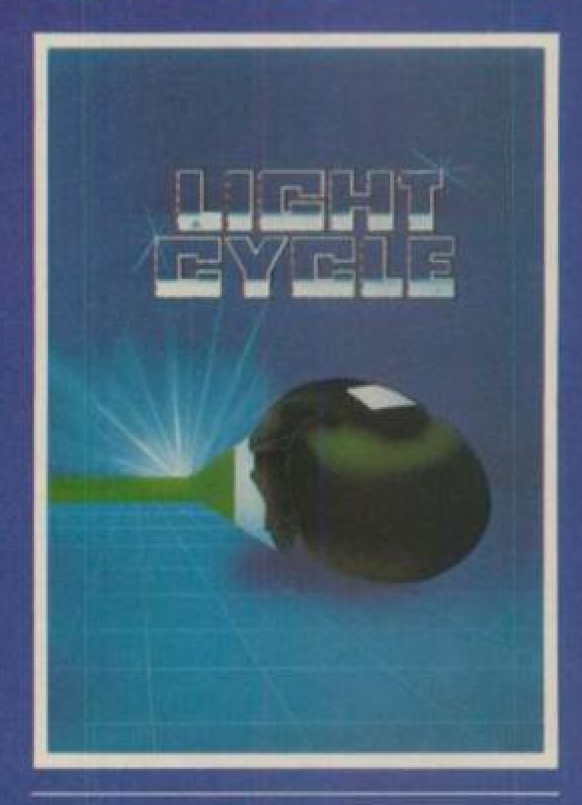
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We DARE you to take control and fight your way to safety.
Unless you can blast a way through your ship will be crushed.

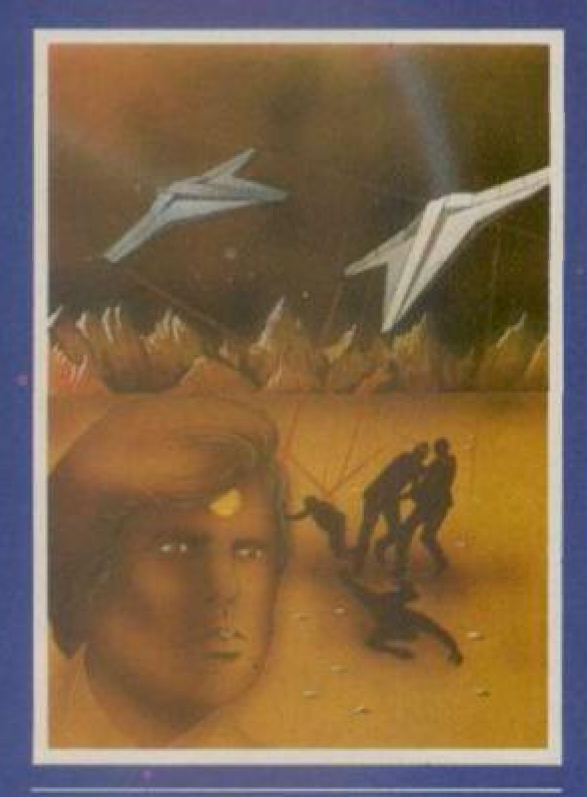
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Although the NewBrain is conceived as a total system, the unexpanded Processor itself has a great deal to offer. It is available in two forms: Model AD, shown below, with a built-in line display; and Model A, without the line display. Both models can operate with a monitor or a television set.

MEMORY

- 24K bytes of ROM;
- 32 bytes of RAM, at least 28K of which is available to the user.

THE SCREEN DISPLAY

- 40 or 80 characters to the line – without affecting the 28K bytes of RAM at your disposal;
- 24 or 30 lines to the screen;
- well-formed characters, with true descenders;
- a full European character set;
- normal or reverse video, high resolution graphics on screen of controllable size, 256, 320, 512 or 640 horizontal resclution by 250 vertical lines;
- a facility to set up a "page" of up to 255 lines, with the screen acting as a "window" to display it;
- ability to ma ntain several such pages simultaneously, and to switch rapidly between them;
- text may be used on graphics screen as well as on parts of the video screen not used by graphics.

CHARACTER SET

- 512 characters, including the full ASCII set, all European accented characters, Greek and graphics symbols.

GRAPHICS

- 20 powerful graphics commands;
- all text characters usable on the graphics screen;
- variable-sized graphics screen, with the rest of the screen available for text – for versatility and to save memory.

SOFTWARE

Enhanced ANSI BASIC; screen editor (32 commands); mathematics package (10 significant figures); graphics commands.

- a very frierdly screen editor – a delight to use and readily adapted to text processing;
- arithmetic to 10 significant figures;
- very controllable output formatting of numbers – invaluable for accounting, statistics, and scientific applications;
- a powerfu, much enhanced BASIC;
- a very flexible operating system, which allows any data stream to be opened to any device.

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- two tape cassette ports built into the processor unit;
- a built-in printer interface;
- a built-in communications interface (V24/RS232);
- a video monitor interface;
- a TV interface;
- an expansion interface for NewBrain system expansion modules.

KEYBOARD

- standard typewriter pitch, action, layout and size, with editing control and graphics keys.



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If you understand the facts and figures on the left you'll soon realise that NewBrain has to be one of the most powerful micros around.

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Detective

Gary Gates,
Huyton-with-Roby,
Lincolnshire.



THE PROGRAM is a problem-solving game asking the player to use his deductive powers. It begins by showing a plan of Clive's House on the screen in which a murder has taken place. It is the task of the player to deduce the room where the murder took place; the murder weapon; the murderer's motive; who committed the murder.

Each time the game is played the computer randomly generates a different code based on the four above parameters, and it is the task of the player to find out this code.

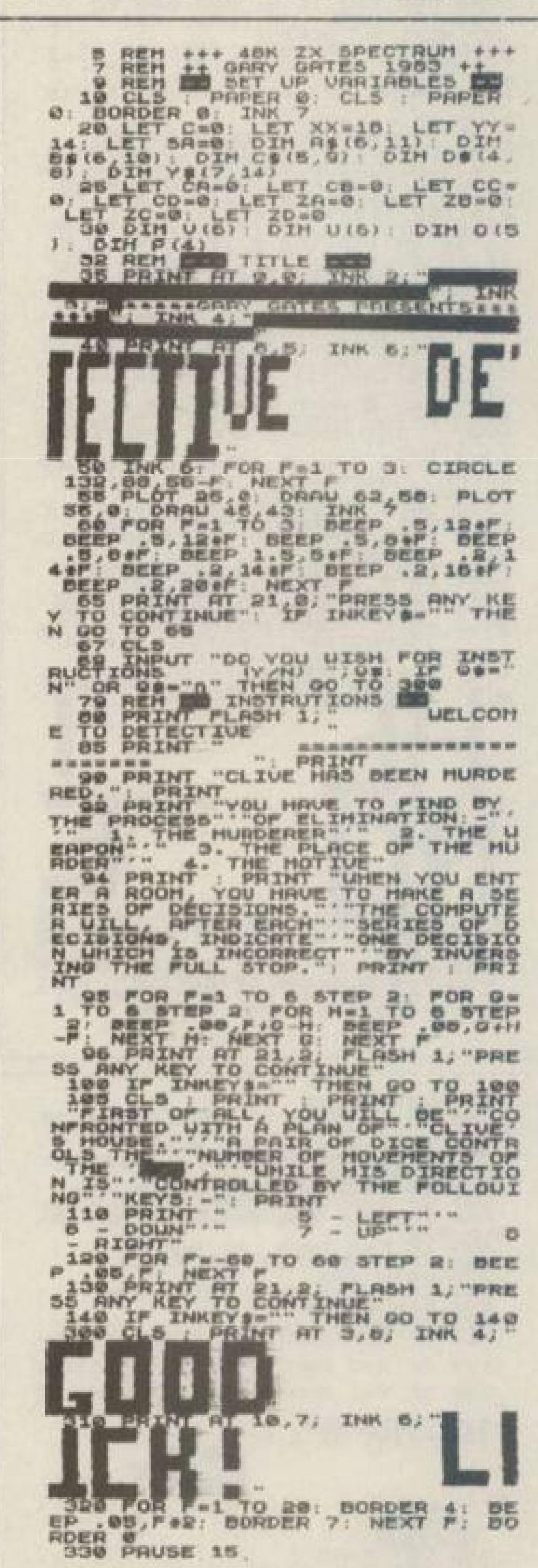
To help solve the code, the player has control of a man, shown on the plan of Clive's House. The man is controlled by the four cursor keys and the number of movements it can make is determined by a pair of dice shown in the centre of the plan, which are controlled by the R key.

The initial task of the player is to move the man around the plan and enter one of the rooms.

On entering any room, the list of possibilities is automatically shown on the screen and the player is invited to select his choices. After inputting the choices, if they prove to be correct then a "Won" message is flashed on to the screen along with a score and a rating.

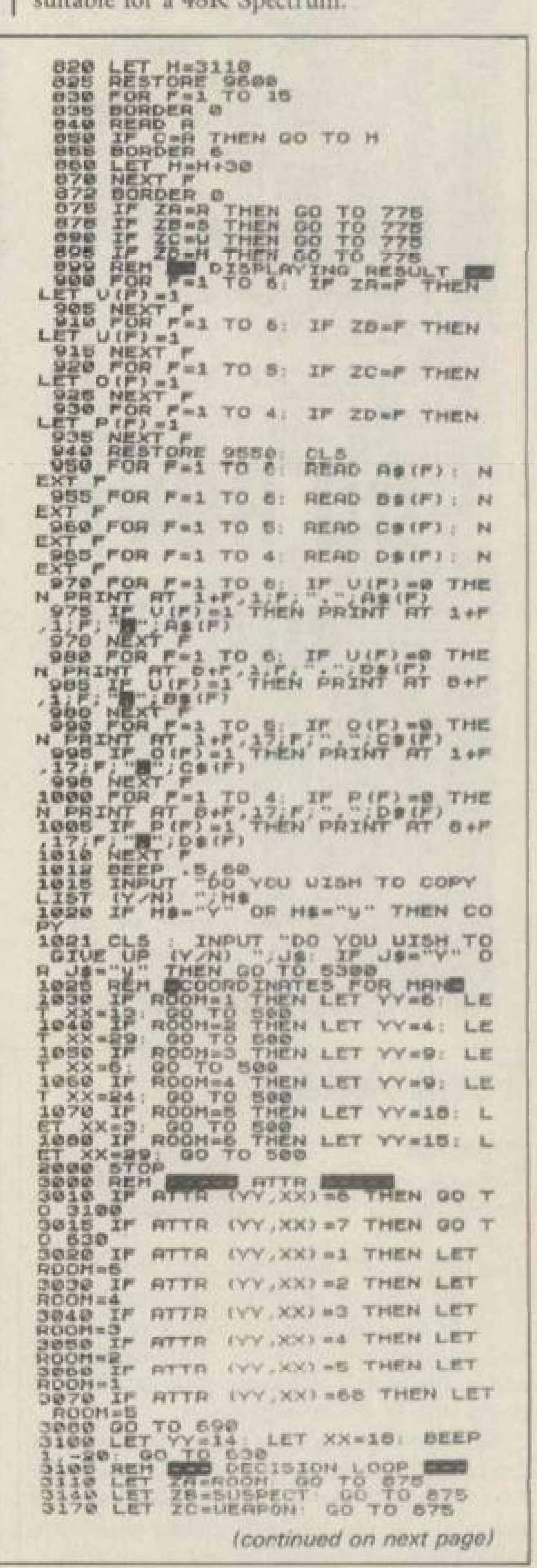
If the choices prove to be incorrect, then the list of possibilities is again flashed onto the screen but, this time, one choice which was incorrect is indicated by an inverted full stop. The player is then invited to continue the game. If the invitation is accepted, then the cycle is repeated.

However, if the player decides to quit before solving the code, then a failure notice is flashed on the screen. This program is only suitable for a 48K Spectrum.



```
5 REM +++ 48K ZX SPECTRUM +++
7 REM ++ GARY GATES 1983 ++
9 REM SET UP VARIABLES
10 CLS : PAPER 0: CLS : PAPER 0: BORDER 0: INK 7
20 LET C=0: LET XX=18: LET YY=14: LET SA=0: DIM A$(6,11): DIM B$(6,10): DIM C$(5,9): DIM D$(4,8): DIM Y$(7,14)
25 LET CA=0: LET CB=0: LET CC=0: LET CD=0: LET ZA=0: LET ZB=0: LET ZC=0: LET ZD=0
30 DIM V(6): DIM U(6): DIM O(5): DIM P(4)
32 REM TITLE
35 PRINT AT 0,0; INK 2;"     "; INK 5;"*******GARY GATES PRESENTS******"; INK 4;"     "
40 PRINT AT 6,5; INK 6;"DETECTIVE"
50 INK 6: FOR F=1 TO 3: CIRCLE 132,88,56-F: NEXT F
55 PLOT 26,0: DRAW 62,58: PLOT 36,0: DRAW 45,43: INK 7
60 FOR F=1 TO 3: BEEP .5,12*F: BEEP .5,12*F: BEEP .5,8*F: BEEP .5,8*F: BEEP 1.5,5*F: BEEP .2,14*F: BEEP .2,14*F: BEEP .2,16*F: BEEP .2,20*F: NEXT F
65 PRINT AT 21,0;"PRESS ANY KEY TO CONTINUE": IF INKEY$="" THEN GO TO 65
67 CLS
69 INPUT "DO YOU WISH FOR INSTRUCTIONS    (Y/N) ";Q$: IF Q$="N" OR Q$="n" THEN GO TO 300
79 REM INSTRUTIONS
80 PRINT FLASH 1;"       WELCOME TO DETECTIVE      "
85 PRINT "      ======================": PRINT
90 PRINT "CLIVE HAS BEEN MURDERED.": PRINT
92 PRINT "YOU HAVE TO FIND BY THE PROCESS""OF ELIMINATION:-"'"  1. THE MURDERER"'"  2. THE WEAPON"'"  3. THE PLACE OF THE MURDER"'"  4. THE MOTIVE"
94 PRINT : PRINT "WHEN YOU ENTER A ROOM, YOU HAVE TO MAKE A SERIES OF DECISIONS."'"THE COMPUTER WILL, AFTER EACH"'"SERIES OF DECISIONS, INDICATE"'"ONE DECISION WHICH IS INCORRECT"'"BY INVERSING THE FULL STOP.": PRINT : PRINT
95 FOR F=1 TO 6 STEP 2: FOR G=1 TO 6 STEP 2: FOR H=1 TO 6 STEP 2: BEEP .08,F+G-H: BEEP .08,G+H-F: NEXT H: NEXT G: NEXT F
96 PRINT AT 21,2; FLASH 1;"PRESS ANY KEY TO CONTINUE"
100 IF INKEY$="" THEN GO TO 100
105 CLS : PRINT : PRINT : PRINT "FIRST OF ALL, YOU WILL BE"'"CONFRONTED WITH A PLAN OF"'"CLIVE'S HOUSE."'"A PAIR OF DICE CONTROLS THE"'"NUMBER OF MOVEMENTS OF THE  ,"'"WHILE HIS DIRECTION IS"'"CONTROLLED BY THE FOLLOWING"'"KEYS:-": PRINT
110 PRINT "           5 - LEFT"'"6 - DOWN"'"           7 - UP"'"           8 - RIGHT"
120 FOR F=-60 TO 60 STEP 2: BEEP .05,F: NEXT F
130 PRINT AT 21,2; FLASH 1;"PRESS ANY KEY TO CONTINUE"
140 IF INKEY$="" THEN GO TO 140
300 CLS : PRINT AT 3,8; INK 4;"GOOD"
310 PRINT AT 10,7; INK 6;"LUCK!"
320 FOR F=1 TO 20: BORDER 4: BEEP .05,F*2: BORDER 7: NEXT F: BORDER 0
330 PAUSE 15
```

```
449 REM RND STATEMENTS
450 LET R=INT (RND*6)+1
460 LET S=INT (RND*6)+1
470 LET W=INT (RND*5)+1
480 LET M=INT (RND*4)+1
490 REM SETTING UP BOARD
500 CLS : GO TO 8000
510 PRINT AT YY,XX; INK 8;"A"
520 PRINT AT 21,0; FLASH 1;"PRESS R TO ROLL DICE"
522 IF INKEY$="R" OR INKEY$="r" THEN GO TO 524
523 GO TO 520
524 PRINT AT 21,0; INK 6;"
525 PRINT AT 10,16;"BC";AT 11,16;"DE";AT 10,19;"BC";AT 11,19;"DE"
527 REM ROLLING DICE
530 LET DA=INT (RND*6)+1: LET DB=INT (RND*6)+1
535 LET A=135: LET D=88
540 FOR F=1 TO 2
550 IF F=1 THEN LET L=DA
555 IF F=2 THEN LET L=DB
560 IF L=1 THEN GO TO 4000
562 IF L=2 THEN GO TO 4010
564 IF L=3 THEN GO TO 4020
568 IF L=4 THEN GO TO 4030
570 IF L=5 THEN GO TO 4040
572 IF L=6 THEN GO TO 4050
580 LET A=A+24
585 BEEP .1,-10
590 NEXT F
600 LET SA=SA+1: LET L=DA+DB
605 REM MOVING MAN
610 FOR F=1 TO L+1
620 LET XX=XX+(INKEY$="8")-(INKEY$="5")
621 LET YY=YY+(INKEY$="6")-(INKEY$="7")
625 GO TO 3000
630 PRINT AT YY,XX; INK 5;"H"
635 BEEP .2,30: PAUSE 5
638 PRINT AT YY,XX;"F"
639 IF INKEY$="" THEN GO TO 620
640 NEXT F
645 PRINT AT YY,XX;"A"
650 GO TO 520
690 RESTORE 9550
695 REM DETECTIVE LIST
700 FOR F=1 TO 6: READ A$(F): NEXT F
705 FOR F=1 TO 6: READ B$(F): NEXT F
710 FOR F=1 TO 5: READ C$(F): NEXT F
715 FOR F=1 TO 4: READ D$(F): NEXT F
720 CLS : PLOT 0,0: DRAW 0,175: DRAW 255,0: DRAW 0,-175: DRAW -255,0: PLOT 111,0: DRAW 0,175
725 FOR F=1 TO 6: PRINT AT 1+F,1;F;".";B$(F): NEXT F
730 FOR F=1 TO 5: PRINT AT 8+F,1;F;".";C$(F): NEXT F
735 FOR F=1 TO 4: PRINT AT 14+F,1;F;".";D$(F): NEXT F
739 REM INPUTTING CHOICES
740 PRINT AT 2,15;"YOU ARE IN ";AT 3,15;"THE ";A$(ROOM)
745 INPUT "SUSPECT (1 TO 6) ";SUSPECT
747 IF SUSPECT<1 OR SUSPECT>6 THEN GO TO 745
750 PRINT AT 5,15;"SUSPECT:";AT 6,19;B$(SUSPECT)
755 INPUT "WEAPON (1 TO 5) ";WEAPON
757 IF WEAPON<0 OR WEAPON>5 THEN GO TO 755
760 PRINT AT 8,15;"WEAPON:";C$(WEAPON)
765 INPUT "MOTIVE (1 TO 4) ";MOTIVE
767 IF MOTIVE<0 OR MOTIVE>4 THEN GO TO 765
770 PRINT AT 10,15;"MOTIVE:";D$(MOTIVE)
774 REM MAIN LOOP
775 LET X=0: LET CA=0: LET CB=0: LET CC=0: LET CD=0: LET ZA=0: LET ZB=0: LET ZC=0: LET ZD=0
780 IF A$(ROOM)<>A$(R) THEN LET CA=1
785 IF B$(SUSPECT)<>B$(S) THEN LET CB=100
790 IF C$(WEAPON)<>C$(W) THEN LET CC=7
795 IF D$(MOTIVE)<>D$(M) THEN LET CD=200
800 LET C=CA+CB+CC+CD
810 IF C=0 THEN GO TO 5000
```



```
820 LET H=3110
825 RESTORE 9600
830 FOR F=1 TO 15
835 BORDER 0
840 READ A
850 IF C=A THEN GO TO H
855 BORDER 6
860 LET H=H+30
870 NEXT F
872 BORDER 0
875 IF ZA=R THEN GO TO 775
878 IF ZB=S THEN GO TO 775
890 IF ZC=W THEN GO TO 775
895 IF ZD=M THEN GO TO 775
899 REM DISPLAYING RESULT
900 FOR F=1 TO 6: IF ZA=F THEN LET V(F)=1
905 NEXT F
910 FOR F=1 TO 6: IF ZB=F THEN LET U(F)=1
915 NEXT F
920 FOR F=1 TO 5: IF ZC=F THEN LET O(F)=1
925 NEXT F
930 FOR F=1 TO 4: IF ZD=F THEN LET P(F)=1
935 NEXT F
940 RESTORE 9550: CLS
950 FOR F=1 TO 6: READ A$(F): NEXT F
955 FOR F=1 TO 6: READ B$(F): NEXT F
960 FOR F=1 TO 5: READ C$(F): NEXT F
965 FOR F=1 TO 4: READ D$(F): NEXT F
970 FOR F=1 TO 6: IF V(F)=0 THEN PRINT AT 1+F,1;F;".";A$(F)
975 IF V(F)=1 THEN PRINT AT 1+F,1;F;" ";A$(F)
978 NEXT F
980 FOR F=1 TO 6: IF U(F)=0 THEN PRINT AT 8+F,1;F;".";B$(F)
985 IF U(F)=1 THEN PRINT AT 8+F,1;F;" ";B$(F)
988 NEXT F
990 FOR F=1 TO 5: IF O(F)=0 THEN PRINT AT 1+F,17;F;".";C$(F)
995 IF O(F)=1 THEN PRINT AT 1+F,17;F;" ";C$(F)
998 NEXT F
1000 FOR F=1 TO 4: IF P(F)=0 THEN PRINT AT 8+F,17;F;".";D$(F)
1005 IF P(F)=1 THEN PRINT AT 8+F,17;F;" ";D$(F)
1010 NEXT F
1012 BEEP .5,60
1015 INPUT "DO YOU WISH TO COPY LIST (Y/N) ";H$
1020 IF H$="Y" OR H$="y" THEN COPY
1021 CLS : INPUT "DO YOU WISH TO GIVE UP (Y/N) ";J$: IF J$="Y" OR J$="y" THEN GO TO 5300
1025 REM COORDINATES FOR MAN
1030 IF ROOM=1 THEN LET YY=6: LET XX=13: GO TO 500
1040 IF ROOM=2 THEN LET YY=4: LET XX=29: GO TO 500
1050 IF ROOM=3 THEN LET YY=9: LET XX=6: GO TO 500
1060 IF ROOM=4 THEN LET YY=9: LET XX=24: GO TO 500
1070 IF ROOM=5 THEN LET YY=18: LET XX=3: GO TO 500
1080 IF ROOM=6 THEN LET YY=15: LET XX=29: GO TO 500
2000 STOP
3000 REM ATTR
3010 IF ATTR (YY,XX)=6 THEN GO TO 3100
3015 IF ATTR (YY,XX)=7 THEN GO TO 630
3020 IF ATTR (YY,XX)=1 THEN LET ROOM=6
3030 IF ATTR (YY,XX)=2 THEN LET ROOM=4
3040 IF ATTR (YY,XX)=3 THEN LET ROOM=3
3050 IF ATTR (YY,XX)=4 THEN LET ROOM=2
3060 IF ATTR (YY,XX)=5 THEN LET ROOM=1
3070 IF ATTR (YY,XX)=68 THEN LET ROOM=5
3080 GO TO 690
3100 LET YY=14: LET XX=18: BEEP 1,-20: GO TO 630
3105 REM DECISION LOOP
3110 LET ZA=ROOM: GO TO 875
3140 LET ZB=SUSPECT: GO TO 875
3170 LET ZC=WEAPON: GO TO 875
```

(continued on next page)

(continued from previous page)







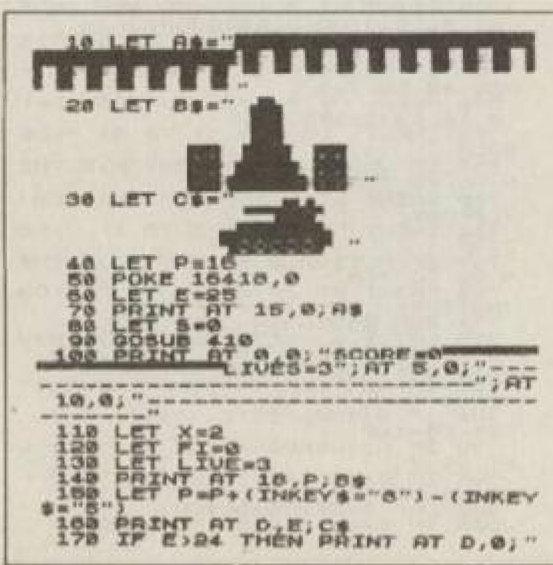
Tank Attack

R Coombs,
Tilehurst,
Berkshire.

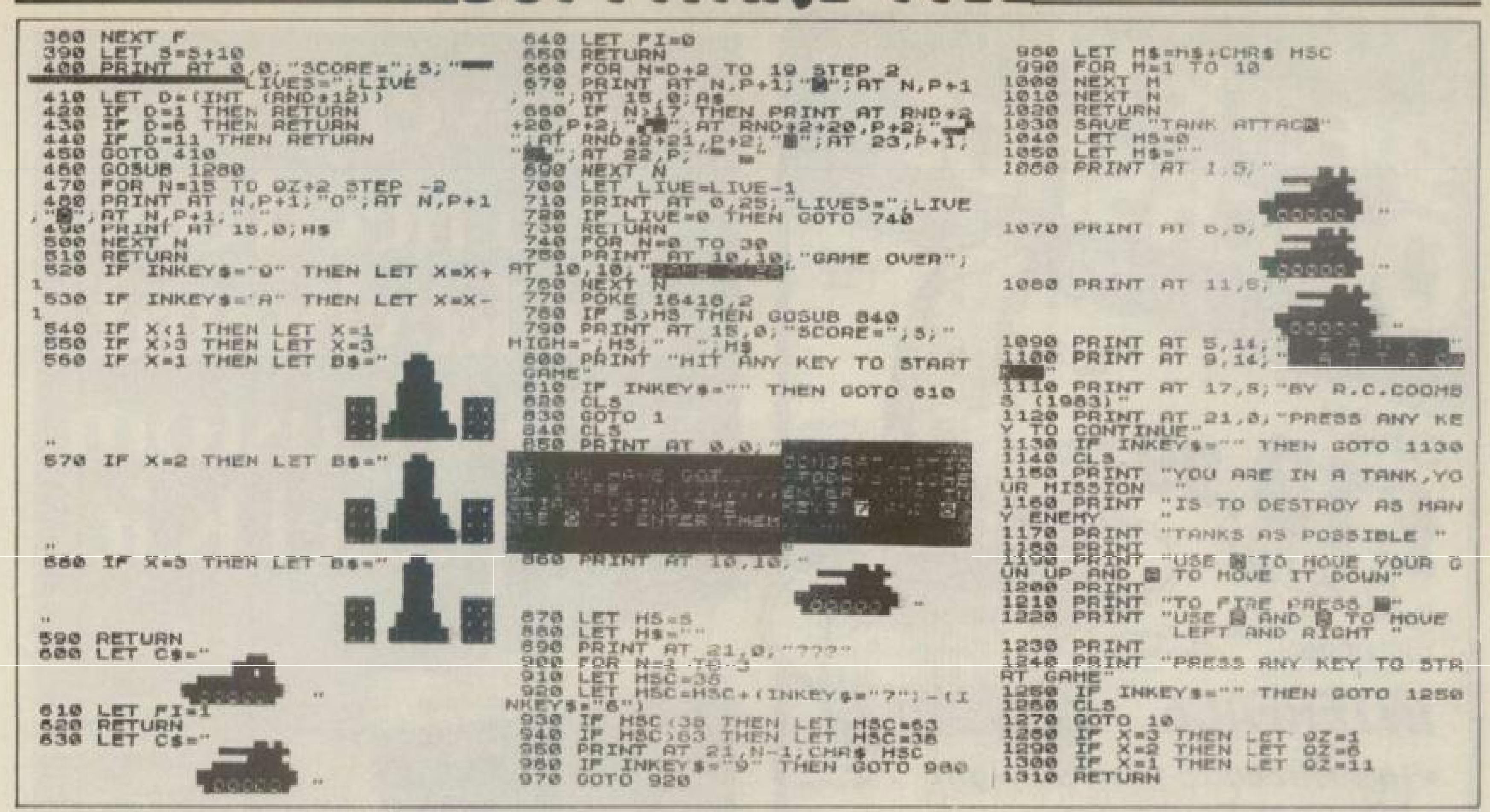
ZX-81

THE OBJECT of Tank Attack for a 16K ZX-81 is to blow up as many of the enemy tanks crossing the bridge as possible. You are in a tank and can move left and right with keys 5 and 8; fire with 7 and move your gun up and down with Q and A respectively.

When your gun is in its highest position you can hit tanks on the far side of the bridge; in its lowest position you can hit tanks on the near side of the bridge and in its middle position it can hit tanks in the middle lane of the bridge.







```
360 NEXT F
390 LET S=S+10
400 PRINT AT 0,0;"SCORE=";S;"
           LIVES=";LIVE
410 LET D=(INT (RND*12))
420 IF D=1 THEN RETURN
430 IF D=6 THEN RETURN
440 IF D=11 THEN RETURN
450 GOTO 410
460 GOSUB 1280
470 FOR N=15 TO OZ+2 STEP -2
480 PRINT AT N,P+1;"O";AT N,P+1
,"█";AT N,P+1;" "
490 PRINT AT 15,0;H$
500 NEXT N
510 RETURN
520 IF INKEY$="Q" THEN LET X=X+
1
530 IF INKEY$="A" THEN LET X=X-
1
540 IF X<1 THEN LET X=1
550 IF X>3 THEN LET X=3
560 IF X=1 THEN LET B$="

"
570 IF X=2 THEN LET B$="

"
580 IF X=3 THEN LET B$="

"
590 RETURN
600 LET C$="
      "
610 LET FI=1
620 RETURN
630 LET C$="
      "
640 LET FI=0
650 RETURN
660 FOR N=D+2 TO 19 STEP 2
670 PRINT AT N,P+1;"█";AT N,P+1
;" ";AT 15,0;A$
680 IF N>17 THEN PRINT AT RND*2
+20,P+2;"█";AT RND*2+20,P+2;"
";AT RND*2+21,P+2;"█";AT 23,P+1;
"█";AT 22,P;"  "
690 NEXT N
700 LET LIVE=LIVE-1
710 PRINT AT 0,25;"LIVES=";LIVE
720 IF LIVE=0 THEN GOTO 740
730 RETURN
740 FOR N=0 TO 30
750 PRINT AT 10,10;"GAME OVER";
AT 10,10;"         "
760 NEXT N
770 POKE 16418,2
780 IF S>HS THEN GOSUB 840
790 PRINT AT 15,0;"SCORE=";S;"
HIGH=";HS;"  ";H$
800 PRINT "HIT ANY KEY TO START
GAME"
810 IF INKEY$="" THEN GOTO 810
820 CLS
830 GOTO 1
840 CLS
850 PRINT AT 0,0;"
"
860 PRINT AT 10,10;"
      "
870 LET HS=S
880 LET H$=""
890 PRINT AT 21,0;"???"
900 FOR N=1 TO 3
910 LET HSC=38
920 LET HSC=HSC+(INKEY$="7")-(I
NKEY$="6")
930 IF HSC<38 THEN LET HSC=63
940 IF HSC>63 THEN LET HSC=38
950 PRINT AT 21,N-1;CHR$ HSC
960 IF INKEY$="9" THEN GOTO 980
970 GOTO 920
980 LET H$=H$+CHR$ HSC
990 FOR M=1 TO 10
1000 NEXT M
1010 NEXT N
1020 RETURN
1030 SAVE "TANK ATTACK"
1040 LET HS=0
1050 LET H$=""
1060 PRINT AT 1,5;"
      "
1070 PRINT AT 6,5;"
      "
1080 PRINT AT 11,5;"
      "
1090 PRINT AT 5,14;" T A N K "
1100 PRINT AT 9,14;" A T T A C
K "
1110 PRINT AT 17,5;"BY R.C.COOMB
S (1983)"
1120 PRINT AT 21,0;"PRESS ANY KE
Y TO CONTINUE"
1130 IF INKEY$="" THEN GOTO 1130
1140 CLS
1150 PRINT "YOU ARE IN A TANK,YO
UR MISSION  "
1160 PRINT "IS TO DESTROY AS MAN
Y ENEMY    "
1170 PRINT "TANKS AS POSSIBLE "
1180 PRINT
1190 PRINT "USE Q TO MOVE YOUR G
UN UP AND A TO MOVE IT DOWN"
1200 PRINT
1210 PRINT "TO FIRE PRESS █"
1220 PRINT "USE █ AND █ TO MOVE
           LEFT AND RIGHT "
1230 PRINT
1240 PRINT "PRESS ANY KEY TO STA
RT GAME"
1250 IF INKEY$="" THEN GOTO 1250
1260 CLS
1270 GOTO 10
1280 IF X=3 THEN LET OZ=1
1290 IF X=2 THEN LET OZ=6
1300 IF X=1 THEN LET OZ=11
1310 RETURN
```

Goldgrabber

Michael Taylor,
Bishop's Stortford,
Hertfordshire.

VIC-20

THIS PROGRAM just fits into an unexpanded Vic. It responds to single key-presses throughout, except during the wizard routine, which uses the Input statement. This is the scenario: you have entered a mythical labyrinth, in your search for the gold that was left there many thousands of years ago, when the inhabitants left.

Since then, the labyrinth has been taken over by various malignant creatures, including orcs, dragons, vampires — even some of the mythical wumpusses have left their dodecahedral caves to make your task harder.

Obviously, these monsters have picked up the gold that was lying around before they came — so you will have to kill to earn your reward. Equally obviously, stronger monsters, for instance, dragons, will have collected more gold than weaker creatures, so it is no use killing nothing but orcs.

You start with a certain number of strength units which are used up every time you move and agility units which are used when fighting — if either of these ratings reaches zero, you will die from your injuries. To see your ratings, including Spells, Gold and Overall score, simply type R.

To aid you in your exploration of the labyrinth, you are equipped with a certain number of magic spells. If used in combat, these will kill any monster with no loss of agility — but you will not get as much gold as you would in a good, honest fight. Also, beware of typing M — the command for a magic spell — if you have already used them all up.

To move North, South East or West, simply type the initial letter of the direction in which you wish to move. If you walk into a pit, you will fall a level, the lower down the labyrinth you are, the stronger the monsters are and the more gold they carry. If you walk up a staircase you will climb a level.

If you climb a staircase on level one or type Q for quit, you will leave the labyrinth: you will be given your final ratings, and the game will end. You can also leave by entering an exit.

I find this game very challenging — I still play it myself, after writing it some time ago. A good score is anything over about 30,000 and the highest score I have seen is just over 51,000. One final note — sometimes a wizard will appear, and try to sell you extra strength points in return for some of your gold. Sometimes this is a good buy, sometimes not. But the wizard is a mercenary devil, and he will charge you as much as he thinks you can afford.

```
0 GOTO100
10 POKE198,0 P=0
20 GETR$ FORI=1TOLEN(C$) IFMID$(C$,I,1)=R$THENF=I
30 NEXT IFP=0THEN20
40 RETURN
50 U=SQR(X*X+Y*Y*Z) W=U-INT(U) RETURN
100 POKE36879,27 PRINTCHR$(8)"        ___________          *** ● /*! 26 ***"
110 PRINTTAB(5)"BY M. TAYLOR."
120 PRINT"EXPLORE THE LABYRINTH IN YOUR SEARCH FOR THE GOLD - MONSTERS WILL"
130 PRINT"OBSTRUCT YOU AND YOU MUST FIGHT THEM."
135 Z=1 H=100 R=500 S=10
150 DIMM$(8) FORI=1TO8 READM$(I) NEXT DATA32OGRE,43WUMPUS,89DRAGON,51MANTICORE,
30ORC
160 DATA76VAMPIRE,99HYDRA,65WRAITH
170 DIMP$(8) FORI=1TO8 READP$(I) NEXT DATA"AN EXIT",STAIRCASE
180 DATAPIT,CHAMBER,CAVE,HALL,DOOR,WALL
190 DIMA$(12) FORI=1TO12 READA$(I) NEXT
200 DATACRYSTAL,VAULTED,WOODEN,VAST,TINY,HUGE,DAMP,DARK,LARGE,SMALL,GLOOMY,EMPT
Y
210 X=2E3 PRINT"ENTER A RANDOM SEED" INPUTX Y=INT(ABS(X*TAN(X))) X=INT(ABS(Y
*ATN(Y)))
400 GOSUB50 W=INT(8*W) IFW=7ORW=0ORW=1ORW=2THENX=X+1 GOTO400
500 PRINTTAB(6)"WAIT ..." C$=" " GOSUB10
1000 H=H-1 IFH<1ORR<1THEN5000
1001 GOSUB50 W=INT(8*W) IFW<1THEN6000
1002 IFW=7THENPRINT"OUCH!" PRINT"THAT WAS A WALL!":X=X-X1 Y=Y-Y1 H=H-4:GOTO4
00
1003 IFW=2THENPRINT"BUMP!" PRINT"YOU FALL A LEVEL." Z=Z+1 Z1=1 GOTO400
1004 IFW=1ANDZ=1THEN6000
1005 IFW=1THENPRINT"..." PRINT"YOU CLIMB A LEVEL." Z=Z-1 Z1=-1 GOTO400
1006 PRINT"YOUR CURRENT LOCATION IS A ";
1007 Q=SQR(X*Y+Y*Z) Q=Q-INT(Q)
1008 PRINTA$(1+10*Q);
1009 PRINT" "P$(1+W)"." PRINT"LEVEL"Z"."
1010 Y=Y-1 GOSUB50 Y=Y+1 PRINT"NORTH IS A "P$(1+8*W)"."
1020 Y=Y+1 GOSUB50 Y=Y-1 PRINT"SOUTH IS A "P$(1+8*W)"."
1030 X=X+1 GOSUB50 X=X-1 PRINT"EAST  IS A "P$(1+8*W)"."
1040 X=X-1 GOSUB50 X=X+1 PRINT"WEST  IS A "P$(1+8*W)"."
1050 M=INT(RND(1)*45)+1 IFM>9OR(M=9ANDO<1000)THEN2000
1055 IFM=9THEN7000
1060 PRINT"YOU ARE CONFRONTED BY A "MID$(M$(M),3)
1065 PRINT" ...,...,... ? "; C$="ARM"
1070 GOSUB10 PRINTCHR$(32+ASC(R$))
1080 IFR$="R"THENX=X-X1 Y=Y-Y1 Z=Z-Z1 PRINT"CHICKEN !!!" GOTO400
1090 IFR$="A"THEN1300
1100 IFS=0THENPRINT"YOU HAVE ALREDY USED  ALL YOUR SPELLS! THE" PRINTMID$(M$
```

(continued on page 161)



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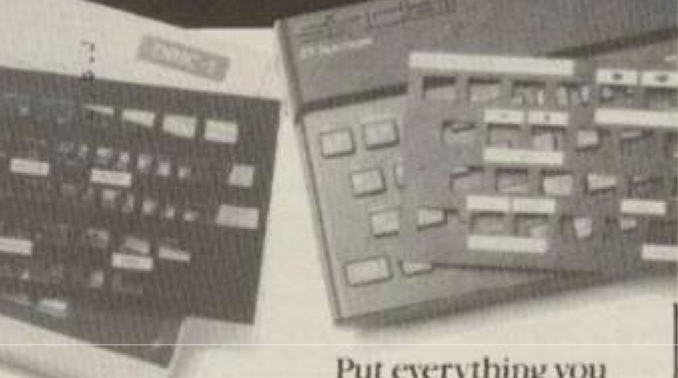
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YC AUG

(continued from page 159)

```
(M),3);
 1110 IFS=0THENPRINT"■ RIPS YOU TO" PRINT"PIECES.■" GOTO6010
 1120 S=S-1 PRINT"■■S YOU SAY THE \AGIC  WORD, A HUGE FIREBALL HITS THE ■"MID$(
M$(M),3)
 1130 GOTO1500
 1300 F=0 V=VAL(LEFT$(M$(M),1))*2*10 W=H*2+((T-1)*3)
 1310 FORQ=1TOINT(V/6)+1 IFFTHEN1330
 1315 V1=INT(3.9*(RND(1)*V+3)) W1=INT(RND(1)*W+2)
 1320 W=W-INT(W1/10) V=V-INT(V1/10) IFW<1ORV<1THENF=1
 1330 NEXT IFW<1THENPRINT"■ HE "MID$(M$(M),3)" HAS KILLED YOU!" GOTO6010
 1340 IFV<1THEN1400
 1350 PRINT"■ HE ■"MID$(M$(M),3)"■ DID"Q PRINT"POINTS DAMAGE AND LEFT" R=R-Q GO
TO500
 1400 PRINT"■HE ■"MID$(M$(M),3)"■ DOES■"Q"■POINTS DAMAGE." R=R-Q
 1500 PRINT"■ HE ■"MID$(M$(M),3)"■ IS ■DEAD."
 1505 F=INT((VAL(MID$(M$(M),2,1))*10+INT(RND(1)*4)+2)*2*1.5) IFR$="M"THENF=INT(F
/2)
 1510 PRINT"■ OU FIND"F"GOLD" PRINT"PIECES." G=G+F
 2000 PRINT"■ ■■■■■■■■■■■■■■■■■■■■ ? "; X1=0 Y1=0 Z1=0
 2010 C$="QNSEWR" GOSUB 0 PRINTCHR$(32+ASC(R$)) IFR$="Q"THENPRINT"■■","." GOTO60
10
 2011 IFR$="R"THENH=H+1 GOSUB9000 GOTO500
 2020 IFR$="N"THENY1=-1
 2030 IFR$="S"THENY1=1
 2040 IFR$="E"THENX1=1
 2050 IFR$="W"THENX1=-1
 2060 X=X+X1 Y=Y+Y1 GOTO1000
 5000 PRINT"■■ OU HAVEN'T GOT ENOUGHSTRENGTH TO GO ON!"
 5010 IFH<0THENH=0
 5020 IFR<0THENR=0
 5030 GOTO6010
 6000 PRINT"■ OU LEFT THE RUIN."
 6010 PRINT"■■ HE END OF THE GAME." GOSUB9000 END
 7000 J=5*(2+INT((G/H/5)*(RND(1)+2))) PRINT"■■ ERE'S A WIZARD WHO SELLS STRENGTH
AT"J
 7002 PRINT"■OLD PIECES PER UNIT."
 7005 PRINT"■ OU HAVE " PRINTG"GOLD PIECES."
 7010 PRINT"■ OW MUCH DO YOU WISH  TO BUY ?"
 7020 INPUTK IFK<0ORK<>INT(K)THENPRINT"■■HOLE POSITIVE NUMBERSONLY, PLEASE!" GO
TO7020
 7030 IFJ*K>GTHENPRINT"■ OU CAN'T AFFORD THAT MUCH!" GOTO7020
 7040 PRINT"■"/," H=H+K G=G-J*K GOTO400
 9000 PRINT"■ OU HAVE ■■" PRINTINT(H)"■■TRENGTH UNITS.■" PRINTR"■■GILITY UNITS.
"
 9010 PRINTS"■■PELLS.■" PRINTG"■ OLD PIECES.■" C=4*H+5*O+15*Z+4*R+20*S-2615
 9020 PRINT"■ OUR ■CORE IS■"C PRINT"■" RETURN
```

Mousetrap

David Cadin,
Trinity, Jersey.



THIS GAME for the BBC Micro with an OS 1.2 requires 32K in its present version, but if all Mode 1 statements are changed to Mode 4 it will run on a Model A.

The game consists of a yellow ball and a green wall which must be manoeuvred around to trap the ball in the red area of the screen. The ball always starts from position 640,30 and the wall starts at 0,0.

If the ball hits the wall or the edge of the screen, it will bounce off but to end the game the ball must be trapped. Lines 1 to 9 set up envelopes and print introduction and instructions; line 10 is the game, calling procedures in order; and lines 11 to 37 are different procedures:

PROCv	Sets up more variables
PROC6	Controls the ball's movements
PROCp	Gets player input and draws and moves the wall
PROCe	Erases ball
PROCpl	Plots ball
PROCsc	Gives score
PROCscr	Scrolls screen
PROCsp	Gets space-bar entry and restarts the game

The main variables are:

H$	Name of player with high score
H%	High score
a	Colour the ball is erased in
SC%	Score — Time/100
gx	x gradient of ball
gy	y gradient of ball
x	x position of ball
y	y position of ball
X1	x position of wall
Y1	y position of wall
X	last x position of wall
Y	last y position of wall

```
   0ONERRORGOTO9
   1REM........MOUSE TRAP..V.1........                    D.CADIN 1983
    **********************************

   2H%=100:H$="DAVE":MODE1:VDU23;8202;0;0;0;
   3ENVELOPE1,&81,&AA,0,10,32,1,20,&7F,&FF,&FD,&FD,&7E,&7E:ENVELOPE2,&11,&22,0,
11,21,10,20,&FF,&7F,&FE,&FA,&7E,&7E:ENVELOPE5,3,2,-4,4,50,50,50,127,0,0,0,126,0
   4FORX=1TO15:PRINT"MOUSE TRAP";"      ";"MOUSE TRAP";"      ";"MOUSE TRAP":NEXT
:SOUND0,-15,7,150:FORP=100TO250:SOUND1,-1,P,1:VDU19,0,P MOD3;0;:NEXT:CLS:*FX15,0
   5SOUND1,-15,0,15:VDU19,0,0;0;:Q=INKEY(100):TIME=0:MODE7:VDU23;8202;0;0;0;:PR
INTTAB(2,20);CHR$130;CHR$136;" D.CADIN 1983":W$="P MOUSE TRA":REPEAT:PROCscr:UNT
ILTIME>1000:MODE7:PRINTTAB(10,2);CHR$129;CHR$136;"MOUSE TRAP"
   6FORX%=3TO24:PRINTCHR$134:NEXT:VDU28,1,24,39,0:PRINTTAB(2,5)"Guide the GREEN
 blocking wall around   and try to get the 'mouse' in the ":PRINTTAB(1,7);CHR$13
0;"TOP LEFT-HAND CORNER"
   7PRINT:PRINT:PRINT:PRINTTAB(2)"Any key to continue":G=GET:CLS:PRINTTAB(10);C
HR$133;"CONTROLS":PRINT:PRINT:PRINT:PRINTTAB(5)"'A' up":PRINTTAB(5)"'Z' down":PR
INTTAB(5)"'<' left":PRINTTAB(5)"'>' right":PRINTTAB(5)"<SPACE BAR> restart"
   8PRINT:PRINT:PRINT:PRINTTAB(2)"Any key to continue":G=GET:*FX15,0
   9TIME=0:MODE1:VDU23;8202;0;0;0;23,130,0,0,0,24,24,0,0,0,19,3,2;0;:GCOL0,1:PR
OCv:REPEAT:PROCb:PROCp:UNTILFALSE:END
  10DEFPROCv:@%=&20210:a=0:SC%=0:gx=10:gy=10:x=640:y=30:X1=0:Y1=0:X=0:Y=0:GCOL0
,1:PLOT69,0,970:PLOT69,0,1023:PLOT85,50,970:PLOT69,50,1023:PLOT85,0,1023:ENDPROC
  11DEFPROCb:PROCe:x=x+gx:y=y+gy:PROCc:PROCpl:ENDPROC
  12DEFPROCc:IF((POINT(x,y)/2)=INT(POINT(x,y)/2)ANDy>25ANDy<1000ANDx>25ANDx<125
8) ENDPROC
  13IFPOINT(x,y)=3 SOUND2,1,100,1:a=3
  14IF(POINT(x,y)=1ANDX1<150ANDY1>900) SOUND3,2,100,100:PROCsc
  15IFSGN(gx)=SGN(gy) gx=-gx ELSEgy=-gy
  16SOUND1,-15,99,1:ENDPROC
  17DEFPROCp:MOVEX1,Y1:IFINKEY(-129) ENDPROC
  18X=X1:Y=Y1
  19IFINKEY(-99) CLS:VDU22,7:HIMEM=21744:GOTO9
  20IFINKEY(-103) X1=X1-10:GOTO24
  21IFINKEY(-104) X1=X1+10:GOTO24
  22IFINKEY(-66) Y1=Y1+10:GOTO24
  23IFINKEY(-98) Y1=Y1-10:GOTO24
  24GCOL0,3:PLOT69,X1,Y1:PLOT69,X1+10,Y1:PLOT85,X1+10,Y1+10:PLOT69,X1,Y1+10:PLO
T85,X1,Y1
  25ENDPROC
  26DEFPROCe:GCOL0,a:PLOT69,x,y:PLOT69,x+3,y:PLOT69,x+3,y+3:PLOT69,x,y+3:a=0:EN
DPROC
  27DEFPROCpl:GCOL0,2:PLOT69,x,y:PLOT69,x+3,y:PLOT69,x+3,y+3:PLOT69,x,y+3:ENDPR
OC
  28DEFPROCsc:CLS:VDU22,7:HIMEM=21744:PRINTTAB(13,5);CHR$130;CHR$136;"''WELL DO
NE!'":PRINTTAB(2,7);CHR$131;"You trapped the mouse in ";INT(TIME/100):PRINTTAB(2
,8);CHR$131;"seconds"
  29*FX15,0
  30SC%=(TIME/100):IFH%>SC% H%=SC%:PRINTTAB(5,10);CHR$130;"Your name:":PRINTTAB
(7,11);CHR$134:INPUTTAB(9,12)N$:H$=N$
  31PROCsp
  32DEFPROCscr:W$=MID$(W$,2,LEN(W$)-1)+MID$(W$,1,1):PRINTTAB(13,10);CHR$129;CHR
$141;W$:PRINTTAB(13,11);CHR$129;CHR$141;W$:Q=INKEY(10):X=X+1:SOUND2,5,X+1,1:ENDP
ROC
  33DEFPROCsp:*FX15,0
  34PRINTTAB(9,12)"Hi-score :";H%;" by ";H$:PRINTTAB(5,20);CHR$131;"Space bar t
o start":REPEAT:UNTILGET=32:VDU22,7:HIMEM=21744:GOTO9
>
```

Lap record

J Hale,
Hammersmith,
London.



LAP RECORD is a joystick-only game for the Dragon 32 in which you have to steer a car along an ever-changing track, avoiding oncoming vehicles and the track walls. You have three laps to complete within a limited time. Instructions are given in the program.

Two machine-code routines are used, one to invert the screen, the other for fast scrolling. The Poke in line 50 speeds up the processor. On some machines this causes problems and should be removed.

There is a 0-7 skill level.

```
30 ' J.HALE
50 POKE &HFFD7,0
60 '*MACHINE CODE DATA FOR INVERT*
70 DATA142,4,0,236,132,136,64,200,64,237,129,140,6,0,37,243,57
80 CLEAR200,32733:FOR A=32751 TO 32767:READ AA:POKE A,AA:NEXT
90 '
100 '*MACHINE CODE DATA SCROLL*
110 DATA142,5,224,16,142,6,0,236,131,237,163,140,4,0,34,247,57
120 FOR A=32734 TO 32750:READ AA:POKE A,AA:NEXT
150 '
160 'INSTRUCTIONS
170 CLS:PRINT TAB(9);STRING$(12,153)
180 PRINT TAB(9);CHR$(153)+"GRAND";+CHR$(153)+"PRIX"+CHR$(153)
190 PRINT TAB(9);STRING$(12,153)
200 PRINT:PRINT" USE THE RIGHT HAND JOYSTICK TO":PRINT"  MOVE YOUR CAR LEFT AND
RIGHT,";:PRINT"     FORWARD(ACCELERATE)":PRINT"       AND BACK(BRAKE)"
210 PRINT"   IF YOU BRAKE TOO MUCH":PRINT"YOU WILL GET A WARNING ":PRINT"    LIG
HT IN THE BOTTOM RIGHT":PRINT"  OF THE SCREEN AND IF YOU DON'T":PRINT"   ACCELER
ATE YOU WILL GET":PRINT"      BRAKE FAILURE"
220 FOR A=1 TO 2:PLAY"T20L3AL9ABO2CL9O1BAGABL3EP4":NEXT
230 PRINT"       PRESS THE SPACEBAR":SCREEN 0,1
240 A$=INKEY$:IF A$=" " THEN 260
250 IF (PEEK(65280)=254 OR PEEK(65280)=126) THEN 260 ELSE 240
260 CLS0:PRINT @8,"GRAND";CHR$(128);"PRIX";:PRINT @32,"YOU HAVE THREE LAPS TO CO
MPLETE":PRINT"  SCORE WILL BE GIVEN AT THE":PRINT"       END OF THE GAME":PRINT @
200,"PRESS THE SPACEBAR";:PRINT @390,"COPYRIGHT J.HALE";:SCREEN 0,1
270 FOR A=1 TO 2000:NEXT
280 A$=INKEY$:IF A$=" " THEN 300
290 IF (PEEK(65280)=254 OR PEEK(65280)=126) THEN 300 ELSE 280
300 '
310 'SKILL LEVEL
320 CLS4:PRINT@197,"SKILL LEVEL 0 TO 7";:PRINT@232,"HARD TO EASY";:SCREEN 0,1
330 A$=INKEY$:IF A$="" THEN 330 ELSE VA=VAL(A$):IF VA>7 THEN 330 ELSE SK=VA+5
340 'VARIABLES
350 D=2:A=0:BW=100:DL=900:TIMER=0:RN=80
360 RD$=CHR$(142)+STRING$(SK,128)+CHR$(143)
```

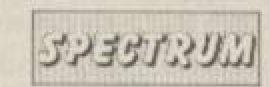
(continued on next page)

(continued from previous page)

```
370 FI$=STRING$(SK,153)
380 C$=CHR$(191):D$=CHR$(143+112)
390 'ROAD
400 CLS
410 FOR S=1 TO 416 STEP 32
420 PRINT @S,RD$;:NEXTS
430 PRINT@258,FI$;
440 'MAIN
450 A=A+(RND(3)-2)
460 PRINT @0,"";
470 IF A<0 THEN A=0
480 IF A>16 THEN A=16
490 PRINT TAB(A);RD$;
500 IF RND(100)>RN THEN PRINT @A+(RND(SK)), CHR$(RND(8)*16+127);
510 POKE 1219+PO,9
520 N=1219+PO
530 V=N-32
540 M=N+32
550 IF PEEK(V)<>128 AND PEEK(V)<>153 THEN PLAY"O1V31T2L4GGL8B-AAGGFEG":CLS:GOTO8
40
560 IF PEEK(V)=153 THEN PLAY"O2V31T5L8GAAEBO3CO2GAGEO1CO3C":GOTO800
570 PLAY"T255L255C"
580 IF B<24 THEN DL=JOYSTK(1)
590 PO=PO+((JOYSTK(0)-30)/20)
600 IF DL>45 THEN B=B+1:BW=BW-3:IF B=>20 THEN PRINT @509,C$;:PLAY"T255L255BAG":I
F B=24 THEN PRINT@495,"BRAKE FAIL";:FOR Z=1 TO 700:NEXT
620 IF TIMER>=2050  THEN PRINT@480,"LAP";:FOR DI=1 TO 100:NEXT:SOUND 25,1:RN=RN-
8:TIMER=0:LAP=LAP+1:IF LAP=3 THEN GOSUB780
630 FOR DE=1 TO DL*5:NEXT
640 SC=SC+1
650 POKE N,128
660 POKE M,128
670 EXEC 32734
680 GOTO 450
690 FOR A=1 TO 5
700 EXEC 32571:SCREEN 0,1:NEXT
710 PLAY"O1T4V31L4GGL7GGL4B-AAGGFEG"
720 CLS
730 PRINT@202,"GAME OVER?";:PRINT @225,"PRESS SPACEBAR FOR ANOTHER GO":SCREEN 0,
1
740 FOR A=1 TO 300
750 A$=INKEY$:IF A$="" THEN NEXT
760 IF A$=CHR$(32) THEN RUN250 ELSE IF A$="Y" THEN CLS:END
770 EXEC 32751:GOTO 740
780 PRINT@0,"";:PRINTTAB(A+1);FI$;
790 RETURN
800 CLS
810 FOR A=36 TO 228 STEP 32
815 PRINT@A,FI$;:NEXT
820 PRINT@228,"C O N G R A T U L A T I O N S !"
840 PRINT@320,"YOUR BRAKES WERE";BW;"%":PRINT"  YOU SCORED ";INT(LAP+1+SC);"POIN
TS"
850 PRINT"    YOU COMPLETED";LAP;:IF LAP=1 THEN PRINT"LAP" ELSE PRINT"LAPS"
860 GOTO 730
```

Histograms

M Furby,
Walton on Thames,
Surrey.



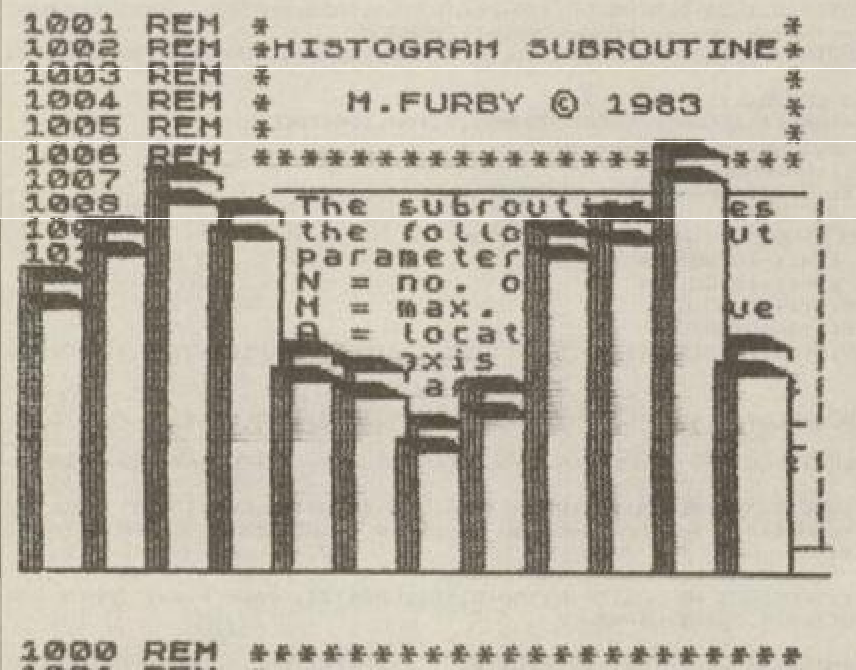
ROBERT NEWMAN'S excellent machine-code animation routine in April *Your Computer* — including the amendment published in the May issue — has uses beyond purely games applications. This subroutine uses it to produce 3D block histograms like those used in *The Money Programme,* a BBC television programme. It is not a complete program in itself, and requires the following parameters to be passed from your main program to run it.

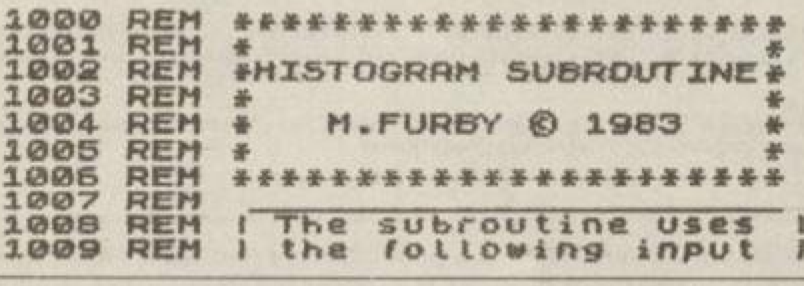
- I(N) ..... an array of values to be graphically depicted
- N .... the number of items in the array
- M .... the maximum value
- A .... the required location of the base line of the histogram

The Poke and Usr addresses are for the 48K Spectrum, and you will need to change them to those in April *Your Computer* if you have a 16K machine.

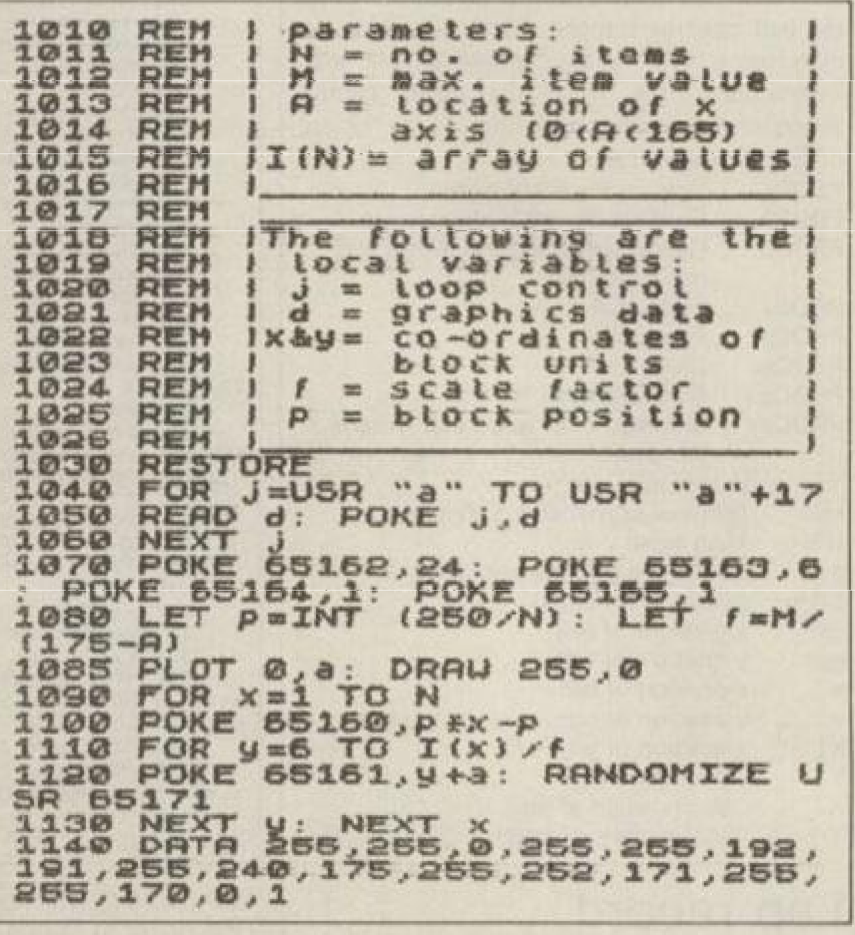
The subroutine will produce a histogram of any number of values, although a practical maximum for clarity is 26. Different values of A, between 0 and 165, will place the base line in a suitable position on the screen to allow for any text you wish to include.

If you wish to show, say, values between 1 and 10, then the routine will draw the block for 10 right to the top of the screen. By giving a false value for M of 20, the blocks will be compressed to give clear space above for further text, so M can be thought of as a magnification factor.





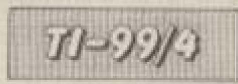
```
1000 REM **********************
1001 REM *                    *
1002 REM *HISTOGRAM SUBROUTINE*
1003 REM *                    *
1004 REM *   M.FURBY © 1983   *
1005 REM *                    *
1006 REM **********************
1007 REM ______________________
1008 REM | The subroutine uses |
1009 REM | the following input |
```



```
1010 REM | parameters:         |
1011 REM | N = no. of items    |
1012 REM | M = max. item value |
1013 REM | A = location of x   |
1014 REM |     axis (0<A<165)  |
1015 REM |I(N)= array of values|
1016 REM |_____________________|
1017 REM
1018 REM |The following are the|
1019 REM | local variables:    |
1020 REM | j = loop control    |
1021 REM | d = graphics data   |
1022 REM |x&y= co-ordinates of |
1023 REM |     block units     |
1024 REM | f = scale factor    |
1025 REM | p = block position  |
1026 REM |_____________________|
1030 RESTORE
1040 FOR j=USR "a" TO USR "a"+17
1050 READ d: POKE j,d
1060 NEXT j
1070 POKE 65162,24: POKE 65163,6
: POKE 65164,1: POKE 65165,1
1080 LET p=INT (250/N): LET f=M/
(175-A)
1085 PLOT 0,a: DRAW 255,0
1090 FOR x=1 TO N
1100 POKE 65160,p*x-p
1110 FOR y=6 TO I(x)/f
1120 POKE 65161,y+a: RANDOMIZE U
SR 65171
1130 NEXT y: NEXT x
1140 DATA 255,255,0,255,255,192,
191,255,240,175,255,252,171,255,
255,170,0,1
```

Limpopo

David Seymour,
East Grinstead,
Sussex.



HERE IS a program for all TI-99/4A users who enjoy music. It will run on ordinary TI Basic. There are seven different drum sounds and a variable delay feature. Here are the specifications for all the drums:

- SIDE .... snare drum with proper decay
- SIDES ...... snare drum with sharp decay used for rolls
- TOM .... tom tom with proper decay
- TOMS ...... tom tom with sharp decay used for rolls
- BASS ...... bass drum "THUD"
- HAT .... a hit of the closed high hat
- CYM(0) ..... a hit of the open high hat
- CYM(1) ..... a hit of the open high hat followed by snare drum
- CYM(2) ..... a hit of the open high hat followed by closing it
- CYM(3) ..... very long cymbal
- CYM(4) ..... only slightly shorter cymbal
- CYM(5) ..... long cymbal
- CYM(6) ..... quite long cymbal
- CYM(8) ..... medium lengthened cymbal
- CYM(10) .... short cymbal
- CYM(14) .... very short cymbal used for cymbal rolls

This is how to use the delay feature. You type Del. The computer asks:

HOW LONG DELAY?

You type any number from 1 to 255. It is advisable to put a delay after every command except Side, Tom, Cym 0, 3, 4, 5 or 6 because those have longer decays to fill in for a delay.

Before running the program, check that program lines 8 to 16 suit your equipment. If you use a cassette player to save the program and your drumbeat on, then leave the lines as

OPEN # 1:"CS1",INTERNAL,(INPUT or OUTPUT),FIXED

but if you have a disc drive, then change them

(continued on page 165)

Spectrum compatible printer

- ★ Obeys standard Spectrum commands.
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- ★ Price includes power supply and interfacing.

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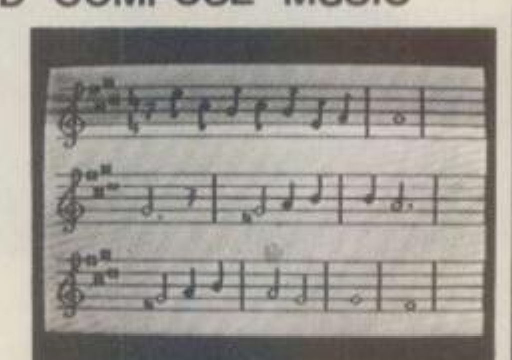
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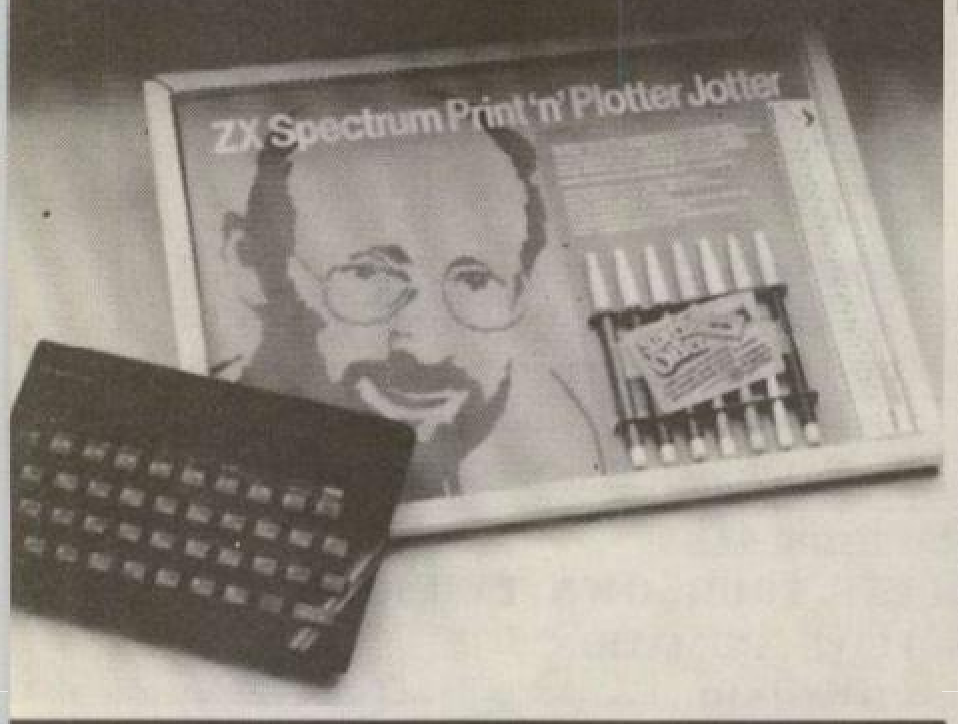
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(continued from page 162)

to OPEN #1:"DSK1.ROCK"
or whatever name you will call the drumbeat when saving it. You do not need a name for the beat if you use a cassette. It is important that you change those lines before running because otherwise, when you have written the beat and then stop to change them, all the variables in which your beat is stored will be gone when you re-run the program.

When the program is run, you will first be confronted with the following menu:

a WRITE A DRUM SEQUENCE
b LIST THE DRUM SEQUENCE
c PLAY THE DRUM SEQUENCE
d MAKE ANY CORRECTIONS
e LOAD DRUM SEQUENCE
f SAVE DRUM SEQUENCE

Obviously if you have only just switched on, you can only do (a) or (e), and if you have not got anything on the cassette or disc, you can only do (a). For (a), here is an example of a drumbeat which you might call Rock:

Computer's questions	Your reply
HOW MANY BEATS IN A BAR ?	7
1 ?	BASS
2 ?	DEL
HOW LONG DELAY ?	5
3 ?	HAT
4 ?	DEL
HOW LONG DELAY ?	5
5 ?	SIDE
6 ?	HAT
7 ?	DEL
HOW LONG DELAY ?	1
ANY CORRECTIONS ?	"N"

Then press (c) to play the drum sequence. It will then be played again and again until you press "s" to return to the menu.

The program can be divided into two parts: Lines 1-129 which make up the "writer" program to input the drumbeat etc. and lines 130-171: the subroutines which actually play the drum sounds. Due to the limits of TI Basic, I could not write the program literally with subroutines, so where as using TI Extended Basic I could put into the program: Call Side for the snare drum routine, in this program I had to put Goto, and then the line number of the routine. Bearing that in mind, a quicker but more laborious method of using the drums would be to only type in lines 130-171, and everywhere there is is a Goto 111, just type in Return. Then in the lines before 130, you could type in Gosubs for the routine you would like to be played. Here is an example:

```
  5 REM "ROCK"
 10 GOSUB 156        (bass)
 15 D(A)=30
 20 GOSUB 146        (delay for 30)
 25 GOSUB 159        (hat)
 30 D(A)=30
 35 GOSUB 146        (delay for 30)
 40 GOSUB 162        (side)
 45 GOSUB 159        (hat)
 50 D(A)-30
 55 GOSUB 146        (delay for 30)
 60 GOTO 10
130 REM CYM(0)       etc
```

```
1 REM  DRUMS-COPYRIGHT 1983 D.H.SEYMOUR
2 REM  START
3 DIM D(100)
4 DIM S(27)
5 DIM C$(256)
6 GOTO 24
7 REM  LOAD beat
8 OPEN #1:"CS1",INTERNAL,INPUT ,FIXED
9 INPUT #1:B
10 FOR A=1 TO B STEP 2
11 INPUT #1:C$(A),S(A),D(A),C$(A+1),S(A+1),D(A+1)
12 NEXT A
13 CLOSE #1
14 GOTO 25
15 REM  SAVE beat
16 OPEN #1:"CS1",INTERNAL,OUTPUT,FIXED
17 PRINT #1:B
18 FOR A=1 TO B STEP 2
19 PRINT #1:C$(A),S(A),D(A),C$(A+1),S(A+1),D(A+1)
20 NEXT A
21 CLOSE #1
22 GOTO 25
23 REM  MENU
24 CALL CLEAR
25 PRINT "WHAT WOULD YOU LIKE TO DO?"
26 PRINT
27 PRINT "a) WRITE A DRUM SEQUENCE      b) LIST
   YOUR DRUM SEQUENCE  c) PLAY THE DR
   UM SEQUENCE   d) MAKE ANY CORRECTIONS"
28 PRINT "e) LOAD DRUM SEQUENCE          f) SAVE
   DRUM SEQUENCE"
29 CALL KEY(5,Z,X)
30 IF X=0 THEN 29
31 IF Z=65 THEN 39
32 IF Z=66 THEN 83
33 IF Z=67 THEN 100
34 IF Z=68 THEN 66
35 IF Z=69 THEN 8
36 IF Z=70 THEN 16
37 GOTO 25
38 REM  INPUT beat
39 CALL CLEAR
40 INPUT "HOW MANY BEATS IN A BAR ?":B
41 IF B>256 THEN 40
42 FOR A=1 TO B
43 PRINT A;
44 INPUT C$(A)
45 IF C$(A)="DEL" THEN 51
46 IF C$(A)="CYM" THEN 54
47 GOSUB 113
48 IF FLAG=1 THEN 58
49 NEXT A
50 GOTO 60
51 INPUT "HOW LONG DELAY ?":D(A)
52 IF D(A)>1024 THEN 51
53 GOTO 49
54 GOSUB 123
55 IF FLAG=1 THEN 49
56 PRINT " * NO SUCH CYMBAL"
57 GOTO 54
58 PRINT " * NO SUCH BEAT"
59 GOTO 43
60 PRINT "ANY CORRECTIONS?(Y/N)"
61 CALL KEY(5,Z,X)
62 IF X=0 THEN 61
63 IF Z=78 THEN 24
64 IF Z<>89 THEN 60
65 REM  CORRECTIONS
66 PRINT "CORRECTION TO WHICH LINE ?"
67 INPUT A
68 IF A>B THEN 66
69 INPUT "NEW DRUM ?":C$(A)
70 IF C$(A)="DEL" THEN 75
71 IF C$(A)="CYM" THEN 78
72 GOSUB 113
73 IF FLAG=1 THEN 58
74 GOTO 60
75 INPUT "HOW LONG DELAY ?":D(A)
76 IF D(A)>1024 THEN 75
77 GOTO 60
78 GOSUB 123
79 IF FLAG=1 THEN 60
80 PRINT " * NO SUCH CYMBAL"
81 GOTO 78
82 REM  LISTING beat
83 CALL CLEAR
84 FOR A=1 TO B
85 PRINT A;" ";
86 IF C$(A)="DEL" THEN 95
87 IF C$(A)="CYM" THEN 97
88 PRINT C$(A)
89 NEXT A
90 PRINT " * READY *"
91 PRINT " ANY KEY TO CONTINUE"
92 CALL KEY(5,Z,X)
93 IF X=0 THEN 92
94 GOTO 25
95 PRINT "DEL ";D(A)
96 GOTO 89
97 PRINT "CYM ";S(A)
98 GOTO 89
99 REM  PLAY beat
100 FOR A=1 TO B
101 CALL KEY(5,Y,Z)
102 IF Y=83 THEN 24
103 IF C$(A)="DEL" THEN 146
104 IF C$(A)="CYM" THEN 131
105 IF C$(A)="HAT" THEN 159
106 IF C$(A)="SIDE" THEN 162
107 IF C$(A)="SIDES" THEN 150
108 IF C$(A)="TOM" THEN 167
109 IF C$(A)="TOMS" THEN 153
110 IF C$(A)="BASS" THEN 156
111 NEXT A
112 GOTO 100
113 FLAG=1
114 IF C$(A)="TOM" THEN 121
115 IF C$(A)="TOMS" THEN 121
116 IF C$(A)="BASS" THEN 121
117 IF C$(A)="SIDE" THEN 121
118 IF C$(A)="SIDES" THEN 121
119 IF C$(A)="HAT" THEN 121
120 GOTO 122
121 FLAG=0
122 RETURN
123 INPUT "WHICH CYMBAL ?":S(A)
124 SA=S(A)
125 IF SA*(SA-1)*(SA-2)*(SA-3)*(SA-4)*(SA-5)*
   (SA-6)*(SA-8)*(SA-10)*(SA-14)*(SA-2
   6)=0 THEN 128
126 FLAG=0
127 GOTO 129
128 FLAG=1
129 RETURN
130 REM  SOUND ROUTINES
131 REM  CYM(O)
132 O=S(A)
133 FOR X=0 TO 10 STEP 2
134 IF O>=3 THEN 136
135 CALL SOUND(-40,-5,X+5)
136 NEXT X
137 IF O<>1 THEN 140
138 CALL SOUND(3,-6,0)
139 GOTO 111
140 IF O<>2 THEN 142
141 GOTO 156
142 FOR X=0 TO 12 STEP O-2
143 CALL SOUND(-40,-5,X)
144 NEXT X
145 GOTO 111
146 REM  DEL(D)
147 FOR DEL=1 TO D(A)
148 NEXT DEL
149 GOTO 111
150 REM  SIDES
151 CALL SOUND(3,-6,1)
152 GOTO 111
153 REM  TOMS
154 CALL SOUND(3,140,3,-7,8)
155 GOTO 111
156 REM  BASS
157 CALL SOUND(-40,-7,5,110,5)
158 GOTO 111
159 REM  HAT
160 CALL SOUND(2,-5,12)
161 GOTO 111
162 REM  SIDE
163 FOR X=1 TO 18 STEP 6
164 CALL SOUND(-40,-6,X)
165 NEXT X
166 GOTO 111
167 REM  TOM
168 FOR X=0 TO 18 STEP 9
169 CALL SOUND(-40,140,X+3,-7,X+07)
170 NEXT X
171 GOTO 111
```

Wild Life

Tony Roberts,
Liverpool.



ONE OF the greatest problems I have with my Spectrum is not mentioned in any of the manuals — the insistence of my four-year old daughter that she should be the one to press the keys. Most of the games I have are simply beyond her, and, as yet, there is no software produced specifically for the pre-school child.

This program has several advantages over a bought program, in any case. It is entirely modular, and plays as many games as you wish in a random sequence: each individual game is a short, simple affair, and it is easy to write your own to fit in with your child's wishes or with what he/she is doing in nursery. The four games in this version are just counting games — in one, 1 to 12 variously coloured butterflies flit around above a field of grass, in another worms of extraordinary lengths crawl out of the grass, the third has flowers of various sizes, and the last apples in a tree.

In each case, the child has to count the butterflies/worms/flowers/apples and press the appropriate number on the keyboard. As I wanted to use numbers up to 12, I redefined the zero key as number 10, the Enter as 11, and space as 12 — and stuck labels marked 10, 11, 12 on to the keys. Various other exciting things happen like a tune — out of the Spectrum manual — when the answer is right, a big cross or tick on the screen as appropriate, and other odd noises at various times.

As usual, the program's organised "back-to-front" in order to speed response times. Each batch of lines 1100-1199, 1200-1299 through to 8800-8899, 8900-8999 is intended to contain a game. Here are the main variables:

Variable	Purpose
o	Set to the number of games to be randomly accessed
m(=1)	Set from the keyboard — silences most of the noisy routines
n	Random number between 1 and 12
n$	String form of n
g	Line number of start of animation routine for each game — this is

(continued on page 167)

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DREAM software

(continued from page 165)

x,y Gosubbed between each scan of Inkey$, so keep it short
x,y Screen co-ordinates

Each routine is accessed 1 to n times to set up your graphics, then g is accessed once between each scan of the keyboard. Pressing m mutes the program, and n will make it noisy again. On line

1210 the graphics characters are A,C
1212 the graphics characters are B,D
1342 the graphics characters are I
1355 the graphics characters are E
1402 the graphics characters are I
1415 the graphics characters are J

```
   1 GO SUB 9500: GO TO 9000: RE
M                      main loop
                       *********
   9 RETURN : REM dummy return
 200 REM            response check
                  **************
 205 IF m=1 THEN GO TO 210
 207 BEEP .005,2+(INT (RND*30))
 225 LET r$=INKEY$
 230 IF r$="" THEN GO SUB g: GO
TO 200
 235 IF r$="m" THEN LET m=1: GO
TO 200
 236 IF r$="n" THEN LET m=0: GO
TO 200
 240 IF r$="0" THEN LET r$="10"
 242 IF r$=CHR$ (13) THEN LET r$
="11"
 244 IF r$=" " THEN LET r$="12"
 250 IF r$<>n$ THEN INK RND*5+1:
 FOR x=5 TO 15: PRINT AT x,x+15;
"■■": PRINT AT x,35-x,"■■": BEEP
 .05,(ABS (x-10)*3): NEXT x: GO
TO 200
 255 GO SUB 9050
 299 RETURN
 500 REM counting games loop
          ********************
 510 LET n=INT (RND*12+1)
 515 LET n$=STR$ (n)
 516 LET c=INT (RND*7): IF c=4 T
HEN GO TO 516
 517 GO SUB 1000
 518 LET rn=INT (RND*o)+1
 520 FOR r=1 TO n
 525 GO SUB rn*100+1000
 530 NEXT r
 535 LET r=1
 540 GO SUB 200
 549 RETURN
1000 REM draw grass
         **********
1005 INK 4
1010 FOR a=1 TO 254 STEP 2
1020 PLOT a,1
1030 DRAW 0,10+(RND*26)
1040 NEXT a
1099 RETURN
1100 REM draw a random flower
         *********************
1105 LET y=INT (RND*80)+60
1110 LET x=INT (RND*200)+27
1111 IF POINT (x,41)+POINT (x+2,
41)+POINT (x-2,41)<>0 THEN GO TO
 1110
1115 INK 4
1120 PLOT x,2
1130 DRAW 0,y
1140 PLOT x-1,2: DRAW 0,y
1150 PLOT x+1,2: DRAW 0,y
1153 LET s=INT (RND*15)+10
1155 LET i=INT (RND*3)+2
1157 INK c
1160 FOR b=1 TO s STEP i
1175 IF m=0 THEN BEEP .001,2*b+1
0
1177 CIRCLE x,y,b
1180 NEXT b
1190 LET g=9
1199 RETURN
1200 REM               butterflies
                       ***********
1207 LET p(r,1)=INT (RND*18): LE
T p(r,2)=INT (RND*30): LET p(r,3
)=INT (RND*7)
1209 GO SUB 1210: LET g=1220: RE
TURN
1210 PRINT AT p(r,1),p(r,2); INK
 p(r,3);"■■"
1212 PRINT AT p(r,1)+1,p(r,2); I
NK p(r,3);"■■"
1215 RETURN
1220 LET r=r+1: IF r>n THEN LET
r=1
1225 PRINT AT p(r,1),p(r,2);"  "
1227 PRINT AT p(r,1)+1,p(r,2);"
 "
1233 LET p(r,1)=p(r,1)+INT (RND*
3)-1
1235 LET p(r,2)=p(r,2)+INT (RND*
3)-1
1236 IF p(r,1)<1 THEN LET p(r,1)
=1
1237 IF p(r,1)>18 THEN LET p(r,1
)=18
1238 IF p(r,2)<1 THEN LET p(r,2)
=1
1239 IF p(r,2)>30 THEN LET p(r,2
)=30
1250 GO SUB 1210
1299 RETURN
1300 REM                     worms
                             *****
1305 LET p(r,1)=17: LET p(r,2)=I
NT ((30/n)*r-RND*(30/n)): LET p(
r,3)=INT (RND*6)
1310 LET g=1330: RETURN
1330 LET r=r+1: IF r>n THEN LET
r=1
1335 INK p(r,3)
1341 LET x1=p(r,1): LET y1=p(r,2
)
1342 PRINT AT x1,y1;"■"
1343 GO TO (1344+RND*4)
1344 LET p(r,1)=p(r,1)+1: GO TO
1350
1345 LET p(r,2)=p(r,2)-1: GO TO
1350
1346 LET p(r,2)=p(r,2)+1: GO TO
1350
1347 LET p(r,1)=p(r,1)-1: GO TO
1350
1350 IF SCREEN$ (p(r,1),p(r,2))<
>" " OR p(r,1)<0 OR p(r,2)>30 OR
 p(r,2)<0 THEN LET p(r,1)=x1: LE
T p(r,2)=y1
1355 PRINT AT p(r,1),p(r,2); INK
 p(r,3);"■"
1399 RETURN
1400 REM             trees/apples
                     ************
1402 IF r=1 THEN FOR x=10 TO 20:
 PRINT INK 4; PAPER 2;AT x,12;"■
■": FOR y=6+ABS (x-14) TO 18-ABS
 (x-14): PRINT PAPER 4;AT x-8,y+
(RND*2)-1;" ": NEXT y: NEXT x
1410 LET p(r,1)=INT (RND*10+2):
LET p(r,2)=INT (RND*12+6): IF AT
TR (p(r,1),p(r,2))<>38 THEN GO T
O 1410
1415 PRINT AT p(r,1),p(r,2); INK
 2; PAPER 7; FLASH 1;"■"
1420 LET g=1499
1499 RETURN
9000 REM                main loop
                        *********
9001 BORDER RND*7
9010 GO SUB 500: REM counting
games
9049 GO TO 9000: REM end of main
 loop
9050 REM right answer!
9051 BORDER RND*7
9055 INK n/2: FOR x=9 TO 15: PRI
NT BRIGHT 1; FLASH 1;AT x,x;"■■"
: NEXT x: FOR x=15 TO 4 STEP -1:
 PRINT BRIGHT 1; FLASH 1;AT x,30
-x;"■■": NEXT x
9057 IF m=0 THEN GO TO 9060
9058 FOR n=1 TO 200: NEXT n
9059 CLS : RETURN
9060 BEEP .25,0: BEEP .25,2: BEE
P .125,3: BEEP .125,2: BEEP .25,
0
9061 BEEP .25,0: BEEP .25,2: BEE
P .125,3: BEEP .125,2: BEEP .25,
0
9062 BEEP .25,3: BEEP .25,5: BEE
P .5,7
9063 BEEP .25,3: BEEP .25,5: BEE
P .5,7
9064 BEEP .1875,7: BEEP .0625,8:
 BEEP .125,7: BEEP .125,5: BEEP
.125,3: BEEP .125,2: BEEP .25,0
9065 BEEP .1875,7: BEEP .0625,8:
 BEEP .125,7: BEEP .125,5: BEEP
.125,3: BEEP .125,2: BEEP .25,0
9066 BEEP .25,0: BEEP .25,-5: BE
EP .5,0
9067 BEEP .5,0: BEEP .5,-5: BEEP
 1,0
9090 CLS
9099 RETURN
9500 REM initialise
9510 LET o=4: REM options
9520 LET r=1: LET m=0: LET b=1
9530 DIM p(12,3): REM screen coo
rdinates and colour
9540 RANDOMIZE
9710 REM set up graphics
9711 POKE USR "a"+0,BIN 01100100
9712 POKE USR "a"+1,BIN 01110010
9713 POKE USR "a"+2,BIN 11111001
9714 POKE USR "a"+3,BIN 11111101
9715 POKE USR "a"+4,BIN 11111111
9716 POKE USR "a"+5,BIN 00111111
9717 POKE USR "a"+6,BIN 00011101
9718 POKE USR "a"+7,BIN 00000001
9721 POKE USR "b"+0,BIN 00000001
9722 POKE USR "b"+1,BIN 00000111
9723 POKE USR "b"+2,BIN 00011111
9724 POKE USR "b"+3,BIN 01111111
9725 POKE USR "b"+4,BIN 11111111
9726 POKE USR "b"+5,BIN 11111111
9727 POKE USR "b"+6,BIN 01111101
9728 POKE USR "b"+7,BIN 01111000
9731 POKE USR "c"+0,BIN 00100110
9732 POKE USR "c"+1,BIN 01001110
9733 POKE USR "c"+2,BIN 10011111
9734 POKE USR "c"+3,BIN 10111111
9735 POKE USR "c"+4,BIN 11111111
9736 POKE USR "c"+5,BIN 11111100
9737 POKE USR "c"+6,BIN 10111000
9738 POKE USR "c"+7,BIN 10000000
9741 POKE USR "d"+0,BIN 10000000
9742 POKE USR "d"+1,BIN 11100000
9743 POKE USR "d"+2,BIN 11111000
9744 POKE USR "d"+3,BIN 11111110
9745 POKE USR "d"+4,BIN 11111111
9746 POKE USR "d"+5,BIN 11111111
9747 POKE USR "d"+6,BIN 10111110
9748 POKE USR "d"+7,BIN 00111100
9751 POKE USR "e"+0,BIN 00111100
9752 POKE USR "e"+1,BIN 01011010
9753 POKE USR "e"+2,BIN 10011001
9754 POKE USR "e"+3,BIN 11011011
9755 POKE USR "e"+4,BIN 11111111
9756 POKE USR "e"+5,BIN 11000011
9757 POKE USR "e"+6,BIN 01100110
9758 POKE USR "e"+7,BIN 00111100
9790 POKE USR "i"+0,BIN 01010101
9791 POKE USR "i"+1,BIN 10101010
9792 POKE USR "i"+2,BIN 01010101
9793 POKE USR "i"+3,BIN 10101010
9794 POKE USR "i"+4,BIN 01010101
9795 POKE USR "i"+5,BIN 10101010
9796 POKE USR "i"+6,BIN 01010101
9797 POKE USR "i"+7,BIN 10101010
9990 POKE USR "j"+0,BIN 00010000
9991 POKE USR "j"+1,BIN 01101010
9992 POKE USR "j"+2,BIN 11111111
9993 POKE USR "j"+3,BIN 11111111
9994 POKE USR "j"+4,BIN 01111111
9995 POKE USR "j"+5,BIN 01111110
9996 POKE USR "j"+6,BIN 00111110
9997 POKE USR "j"+7,BIN 00000000
9999 RETURN
```

Four × four × four

Barrie and Mark Walmsley,
Flackwell Heath,
Buckinghamshire.

ZX-81

THE CONVENTIONAL games of Noughts and Crosses, either three-by-three or three-by-three-by-three, have a limited number of moves and can often result in draws. However, four-by-four-by-four Noughts and Crosses has many more variations and is a worthwhile game requiring skill and concentration as well as good visualisation of a three-dimensional playing area projected into two dimensions.

This program follows the normal convention of showing the playing area as four planes, drawn side by side. These planes should be visualised as lying on top of each other to form a cube — see figure 1. Winning lines can be parallel to any edge of the cube; diagonally across a plane; or diagonally across the cube such as d,d,d,d.

The method adopted by the program is to assign weights to each unoccupied square according to the contents of the lines passing through that square.

You can see that each of the 32 squares which lie on the cube diagonals lie on a total of seven different lines and the remaining squares each lie on four different lines. At the start of the game weights of 40 are assigned to the cube diagonal set and weights of 32 to the others.

Each type of line has a weight value which is assigned to the blank squares in that line. The total weight carried by any blank square is the sum of the weight values of each line which passes through that square.

After each play, by either player or computer, all weights associated with lines passing through the square which has been played into are recalculated. The computer's mode of play is first to check for winning or losing lines and then to play into the vacant square with the highest weight. In the case of equal highest weights, a partially random choice is made.

Following Run, the variables and addresses are assigned to 9500 to 9750 and the parameters pertaining to each square are set up in 9000 to 9260. The main program is entered at 18, the playing area displayed — 18 to 100 — and play starts with the computer assigned O and the player assigned X.

The player makes a move by entering a string of three digits, each between 1 and 4, to denote the plane, row and column on the chosen move. The computer validates the entry, shows the chosen position and asks for verification. Assuming this is given, the player's move is assigned the variables C,D,E and the main routine of the program, Set, is entered at 6000.

Set checks each line through C,D,E, counting the number of Xs and Os — Search — allocating weight adjustments — Update — and recalculating all affected weights — Weight. If three Xs are found then Flag J is set during Update and the line is tagged in parameter 6.

Following a win by either player or

(continued on page 169)



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(continued from page 167)

computer, the winning line is displayed in inverse characters with an appropriate message. The Count variable allows 64 moves before declaring the game a draw.

A section of the program is written in machine code. This speeds up a simple but time-consuming routine to determine the vacant square with the highest weight. Anyone preferring not to use a machine code can delete lines 1-8 and replace 7020-7080 with the Basic routine 7020-7220 on page 170.

The machine code will be set up each time the program is run. This is not necessary, and after the first run lines 2-8 can be deleted, and the program saved in this form. The machine-code assumes A$ is the first variable.

The inverse characters in the listing are:

Line 20	1,2,3,4
Lines 160, 410, 7410, 9900:	X
Lines 420, 2160, 7300:	0

```
   1 REM ...................
.............. 67 CHARACTERS .....
...............
   2 FAST
   3 LET X=16514
   4 LET A$="000001000002A1040110
F00197EFE102016237E8928361220 0CF
0583440CB4320000C84828044F220 2401
10A00019E5118F02A7ED52ED5B1040ED5
23E7FA4857CE1C818C95"
   5 POKE X,16*CODE A$+CODE A$(2
)-476
   6 LET A$=A$(3 TO )
   7 LET X=X+1
   8 IF A$<>"S" THEN GOTO 5
   9 CLEAR
  10 FAST
  15 GOTO 9500
  18 FAST
  19 CLS
  20 PRINT "    ■       ■
■      ■"
  30 PRINT
  40 FOR N=1 TO 4
  50 PRINT N;"  :  :  :   :  :  :   :
  :  :   :  :  :"
  55 IF N=4 THEN GOTO 80
  60 PRINT " -+-+-+- -+-+-+- -+-
+-+- -+-+-+-"
  70 NEXT N
  80 FOR N=1 TO 4
  90 PRINT " 1 2 3 4";
 100 NEXT N
 101 GOTO 300
 103 REM **UPLAY**
 106 SLOW
 107 LET G$="0"
 110 PRINT AT 20,0;"YOUR MOVE?
 "
 120 INPUT B$
 121 IF LEN B$<3 THEN GOTO 120
 122 LET K$="O"
 123 GOSUB INSERT
 130 FOR N=1 TO 3
 140 IF B$(N)<"1" OR B$(N)>"4" T
HEN GOTO 120
 150 NEXT N
 155 LET C=VAL B$(1)
 156 LET D=VAL B$(2)
 157 LET E=VAL B$(3)
 159 GOTO 400
 160 LET K$="X"
 165 GOSUB INSERT
 170 PRINT AT 20,0;"IS THIS CORR
ECT?   (Y/N)"
 180 IF INKEY$="" THEN GOTO 180
 185 LET C$=INKEY$
 190 IF C$="Y" THEN GOTO 240
 200 IF C$="N" THEN GOTO 212
 210 GOTO 180
 212 LET K$=" "
 215 GOSUB INSERT
 220 GOTO 350
 240 FAST
 245 LET A$(C,D,E,4)="2"
 247 LET A$(C,D,E,5)=" "
 250 LET K$="X"
 260 GOSUB INSERT
 265 PRINT AT 20,0;"
 "
 280 GOTO SET
 300 PRINT AT 20,0;"DO YOU WANT
TO PLAY FIRST? (Y/N)"
 305 SLOW
 310 IF INKEY$="" THEN GOTO 310
 315 LET C$=INKEY$
 320 IF C$="Y" THEN GOTO 350
 330 IF C$="N" THEN GOTO 343
 340 GOTO 310
 343 FAST
 345 GOTO IPLAY
 350 LET C=1
 351 LET D=10
 352 LET E=1
 355 GOTO UPLAY
 360 REM **INSERT**
 370 PRINT AT 2*D,8*C+2*E-9;K$
 380 RETURN
 400 IF A$(C,D,E,4)="1" THEN GOT
O 160
 410 IF A$(C,D,E,4)="2" THEN LET
 K$="X"
 420 IF A$(C,D,E,4)="3" THEN LET
 K$="O"
 430 GOSUB INSERT
 435 PRINT AT 20,0;"
 "
 440 PRINT AT 16,0;"SPACE ALREAD
Y OCCUPIED"
 450 PRINT AT 16,0;"PRESS ANY KE
Y TO CONTINUE"
 460 IF INKEY$="" THEN GOTO 460
 470 PRINT AT 16,0;"
 
 "
 480 IF A$(C,D,E,4)="2" THEN LET
 K$="X"
 490 IF A$(C,D,E,4)="3" THEN LET
 K$="O"
 500 GOSUB INSERT
 510 GOTO UPLAY
2000 PRINT AT 16,0;"CONGRATULATI
ONS--YOU HAVE WON"
2010 PRINT AT 16,0;"DO YOU WANT
TO PLAY AGAIN? (Y/N)"
2015 SLOW
2020 IF INKEY$="" THEN GOTO 2020
2025 LET C$=INKEY$
2030 IF C$="Y" THEN RUN
2040 IF C$="N" THEN PRINT AT 16,
0;"THANKS FOR THE GAME, BYE

 "
2050 GOTO 2020
2060 REM **DRAW**
2070 PRINT AT 15,0;"AN HONOURABL
E DRAW"
2080 GOTO 2010
2100 REM **FOUND3O**
2110 FOR X=1 TO 4
2120 FOR Y=1 TO 4
2130 FOR Z=1 TO 4
2140 IF A$(X,Y,Z,6)<"1" OR A$(X,
Y,Z,6)>"7" THEN GOTO 2200
2150 IF A$(X,Y,Z,4)<>"1" THEN GO
TO 2200
2152 LET C=X
2154 LET D=Y
2156 LET E=Z
2158 LET P=VAL A$(X,Y,Z,6)*20
2160 LET K$="O"
2170 GOSUB MARKWIN
2175 GOSUB PRINTWIN
2180 PRINT AT 15,0;"MY GAME THIS
 TIME"
2190 GOTO 2010
2200 NEXT Z
2210 NEXT Y
2220 NEXT X
2225 LET I=0
2240 GOTO 7015
2400 REM **FOUND3X**
2410 FOR X=1 TO 4
2420 FOR Y=1 TO 4
2430 FOR Z=1 TO 4
2440 IF A$(X,Y,Z,6)<>"8" THEN GO
TO 2500
2450 IF A$(X,Y,Z,4)<>"1" THEN GO
TO 2500
2460 LET C=X
2470 LET D=Y
2480 LET E=Z
2485 LET A$(X,Y,Z,6)="0"
2487 LET J=J-1
2490 GOTO 7270
2500 NEXT Z
2510 NEXT Y
2520 NEXT X
2530 LET J=0
2540 GOTO 7020
3000 REM **PRINTWIN**
3010 FOR C=1 TO 4
3020 FOR D=1 TO 4
3030 FOR E=1 TO 4
3040 IF A$(C,D,E,6)="9" THEN GOS
UB INSERT
3050 NEXT E
3060 NEXT D
3070 NEXT C
3080 RETURN
6000 REM **SET**
6005 LET COUNT=COUNT+1
6010 FOR P=20 TO 140 STEP 20
6020 LET L=0
6030 LET M=0
6040 FOR T=1 TO 4
6050 GOSUB (SEARCH+P)
6060 IF Q$(T)="2" THEN LET L=L+1
6070 IF Q$(T)="3" THEN LET M=M+1
6080 NEXT T
6090 GOSUB UPDATE
6100 FOR T=1 TO 4
6110 IF Q$(T)="1" THEN GOSUB (WE
IGHT+P)
6120 NEXT T
6130 NEXT P
6140 IF G$="0" THEN GOTO IPLAY
6150 IF COUNT>63 THEN GOTO DRAW
6170 GOTO UPLAY
6200 REM **SEARCH**
6220 LET Q$(T)=A$(T,D,E,4)
6230 RETURN
6240 LET Q$(T)=A$(C,T,E,4)
6250 RETURN
6260 LET Q$(T)=A$(C,D,T,4)
6270 RETURN
6280 IF A$(C,D,E,7)="1" THEN LET
 Q$(T)=A$(C,T,T,4)
6285 IF A$(C,D,E,7)="2" THEN LET
 Q$(T)=A$(C,T,5-T,4)
6290 RETURN
6300 IF A$(C,D,E,8)="1" THEN LET
 Q$(T)=A$(T,D,T,4)
6305 IF A$(C,D,E,8)="2" THEN LET
 Q$(T)=A$(T,D,5-T,4)
6310 RETURN
6320 IF A$(C,D,E,9)="1" THEN LET
 Q$(T)=A$(T,T,E,4)
6325 IF A$(C,D,E,9)="2" THEN LET
 Q$(T)=A$(T,5-T,E,4)
6330 RETURN
6340 LET R=VAL A$(C,D,E,10)
6341 LET Q$(T)="1"
6342 IF R=0 THEN RETURN
6345 GOTO (SEARCH+P+R*10)
6350 LET Q$(T)=A$(T,T,T,4)
6355 RETURN
6360 LET Q$(T)=A$(T,T,5-T,4)
6365 RETURN
6370 LET Q$(T)=A$(T,5-T,T,4)
6375 RETURN
6380 LET Q$(T)=A$(T,5-T,5-T,4)
6385 RETURN
6400 REM **WEIGHT**
6420 LET A$(T,D,E,5)=CHR$ (CODE
A$(T,D,E,5)+WW)
6430 RETURN
6440 LET A$(C,T,E,5)=CHR$ (CODE
A$(C,T,E,5)+WW)
6450 RETURN
6460 LET A$(C,D,T,5)=CHR$ (CODE
A$(C,D,T,5)+WW)
6470 RETURN
6480 IF A$(C,D,E,7)="1" THEN LET
 A$(C,T,T,5)=CHR$ (CODE A$(C,T,T
,5)+WW)
6485 IF Q$(T)="1" AND A$(C,D,E,7
)="2" THEN LET A$(C,T,5-T,5)=CHR
$ (CODE A$(C,T,5-T,5)+WW)
6490 RETURN
6500 IF A$(C,D,E,8)="1" THEN LET
 A$(T,D,T,5)=CHR$ (CODE A$(T,D,T
,5)+WW)
6505 IF A$(C,D,E,8)="2" THEN LET
 A$(T,D,5-T,5)=CHR$ (CODE A$(T,D
,5-T,5)+WW)
6510 RETURN
6520 IF A$(C,D,E,9)="1" THEN LET
 A$(T,T,E,5)=CHR$ (CODE A$(T,T,E
,5)+WW)
6525 IF A$(C,D,E,9)="2" THEN LET
 A$(T,5-T,E,5)=CHR$ (CODE A$(T,5
-T,E,5)+WW)
6530 RETURN
6540 IF R<>0 THEN GOTO (WEIGHT+P
+R*10)
6545 RETURN
6550 LET A$(T,T,T,5)=CHR$ (CODE
A$(T,T,T,5)+WW)
6555 RETURN
6560 LET A$(T,T,5-T,5)=CHR$ (COD
E A$(T,T,5-T,5)+WW)
6565 RETURN
6570 LET A$(T,5-T,T,5)=CHR$ (COD
E A$(T,5-T,T,5)+WW)
6575 RETURN
6580 LET A$(T,5-T,5-T,5)=CHR$ (C
ODE A$(T,5-T,5-T,5)+WW)
6585 RETURN
6600 REM **UPDATE**
6610 IF G$="1" THEN GOTO UPDATEO
6620 REM **UPDATEX**
6625 LET WW=0
6630 IF L=4 THEN GOTO WWIN
6635 IF M<>0 THEN GOTO 6675
6640 IF L=3 THEN LET WW=(W2-W4)
6650 IF L=3 THEN GOTO POINTX
6660 IF L=2 THEN LET WW=(W4-W7)
6670 IF L=1 THEN LET WW=(W7-W8)
6675 IF L<>1 THEN RETURN
6680 IF M=1 THEN LET WW=(W8-W8)
6690 IF M=2 THEN LET WW=(W8-W3)
6700 RETURN
6710 REM **UPDATEO**
6715 LET WW=0
6720 IF M=4 THEN GOTO 2100
6725 IF L<>0 THEN GOTO 6765
6730 IF M=3 THEN LET WW=(W1-W3)
6740 IF M=3 THEN GOTO POINTO
6750 IF M=2 THEN LET WW=(W3-W5)
6760 IF M=1 THEN LET WW=(W5-W6)
6765 IF M<>1 THEN RETURN
6770 IF L=1 THEN LET WW=(W8-W7)
6780 IF L=2 THEN LET WW=(W8-W3)
6800 RETURN
7000 REM **IPLAY**
7010 IF I>0 THEN GOTO FOUND3O
7015 IF J>0 THEN GOTO FOUND3X
7020 LET HIWT=USR 16516
7030 LET MW=PEEK 16514+256*PEEK
16515
7040 LET MW=(MW-(PEEK 16400+256*
PEEK 16401+15))/10
7050 LET C=INT (MW/16)+1
7060 LET MW=MW-(C-1)*16
7070 LET D=INT (MW/4)+1
7080 LET E=MW-(D-1)*4+1
7270 LET A$(C,D,E,4)="3"
7280 LET A$(C,D,E,5)=" "
7290 LET G$="1"
7295 IF COUNT>63 THEN GOTO DRAW
7300 LET K$="O"
7310 GOSUB INSERT
7330 GOTO SET
7400 REM **WWIN**
7410 LET K$="X"
7420 GOSUB MARKWIN
7430 GOSUB PRINTWIN
7440 GOTO 2000
7480 REM **POINTX**
7500 LET H$="8"
7505 LET J=J+1
7510 GOTO MARK
7520 REM **POINTO**
7540 LET H$=STR$ (P/20)
7545 LET I=1
7550 GOTO MARK
7560 REM **MARKWIN**
7565 FOR T=1 TO 4
7575 LET H$="9"
7580 GOSUB (WINLINE+P)
7590 NEXT T
7595 RETURN
7600 REM **MARK**
7610 FOR T=1 TO 4
7620 GOSUB (WINLINE+P)
7630 NEXT T
7640 RETURN
7700 REM **WINLINE**
7720 LET A$(T,D,E,6)=H$
7730 RETURN
7740 LET A$(C,T,E,6)=H$
7750 RETURN
7760 LET A$(C,D,T,6)=H$
7770 RETURN
7780 IF A$(C,D,E,7)="1" THEN LET
 A$(C,T,T,6)=H$
7785 IF A$(C,D,E,7)="2" THEN LET
 A$(C,T,5-T,6)=H$
7790 RETURN
7800 IF A$(C,D,E,8)="1" THEN LET
 A$(T,D,T,6)=H$
7805 IF A$(C,D,E,8)="2" THEN LET
 A$(T,D,5-T,6)=H$
7810 RETURN
7820 IF A$(C,D,E,9)="1" THEN LET
 A$(T,T,E,6)=H$
7825 IF A$(C,D,E,9)="2" THEN LET
 A$(T,5-T,E,6)=H$
7830 RETURN
7840 LET R=VAL A$(C,D,E,10)
7845 GOTO (WINLINE+P+R*10)
7850 LET A$(T,T,T,6)=H$
7855 RETURN
7860 LET A$(T,T,5-T,6)=H$
7865 RETURN
7870 LET A$(T,5-T,T,6)=H$
7875 RETURN
7880 LET A$(T,5-T,5-T,6)=H$
7885 RETURN
9000 REM **SETUP**
9010 FOR X=1 TO 4
9020 FOR Y=1 TO 4
9030 FOR Z=1 TO 4
9040 LET F$(1)=CHR$ (X+28)
9050 LET F$(2)=CHR$ (Y+28)
9060 LET F$(3)=CHR$ (Z+28)
9070 LET F$(4 TO 10)="1000000"
9080 IF Y=Z THEN LET F$(7)="1"
9090 IF Y+Z=5 THEN LET F$(7)="2"
9100 IF X=Z THEN LET F$(8)="1"
9110 IF X+Z=5 THEN LET F$(8)="2"
9120 IF X=Y THEN LET F$(9)="1"
9130 IF X+Y=5 THEN LET F$(9)="2"
9140 IF F$(7)="1" AND F$(8)="1"
```

(continued on next page)

(continued from previous page)

```
THEN LET F$(10)="1"
9150 IF F$(9)="1" AND F$(8)="2"
THEN LET F$(10)="2"
9155 IF F$(8)="1" AND F$(7)="2"
THEN LET F$(10)="3"
9160 IF F$(8)="2" AND F$(9)="2"
THEN LET F$(10)="4"
9170 LET V=3
9180 IF F$(7)<>"0" THEN LET V=V+
1
9190 IF F$(8)<>"0" THEN LET V=V+
1
9200 IF F$(9)<>"0" THEN LET V=V+
1
9210 IF F$(10)<>"0" THEN LET V=V
+1
9215 IF V>=8 THEN LET V=8
9220 LET F$(5)=CHR$ (V+U8)
9230 LET A$(X,Y,Z)=F$
9240 NEXT Z
9250 NEXT Y
9260 NEXT X
9270 GOTO 10
9500 DIM A$(4,4,4,10)
9503 LET COUNT=0
9505 LET M$="0"
9507 LET J=0
9508 LET I=0
9510 DIM F$(10)
9515 DIM Q$(4)
9520 LET U1=35
9530 LET U2=35
9540 LET U3=25
9550 LET U4=30
9560 LET U5=15
9570 LET U6=8
9580 LET U7=15
9590 LET U8=2
9610 LET UPLAY=103
9615 LET INSERT=360
9616 LET DRAW=2060
9617 LET FOUND30=2100
9618 LET FOUND3X=2400
9619 LET PRINTWIN=3000
9620 LET SET=6000
9630 LET SEARCH=6200
9640 LET WEIGHT=6400
9650 LET UPDATE=6600
9660 LET UPDATEX=6620
9670 LET UPDATEO=6710
9680 LET IPLAY=7000
9690 LET WWIN=7400
9710 LET POINTX=7480
9720 LET POINTO=7520
9725 LET MARKWIN=7560
9730 LET MARK=7600
9740 LET WINLINE=7700
9750 LET SETUP=9000
9800 GOTO SETUP
9900 SAVE "3D4█"
9910 RUN
```

The Basic routine.

```
7020 LET HIWT=0
7030 FOR X=1 TO 4
7040 FOR Y=1 TO 4
7050 FOR Z=1 TO 4
7060 IF A$(X,Y,Z,4)<>"1" THEN GO
TO 7200
7070 LET WT=CODE A$(X,Y,Z,5)
7080 IF WT<HIWT THEN GOTO 7200
7090 IF WT=HIWT AND RND>.33 THEN
 GOTO 7200
7100 LET HIWT=WT
7110 LET C=X
7120 LET D=Y
7130 LET E=Z
7200 NEXT Z
7210 NEXT Y
7220 NEXT X
```

Keyword define

J Bradshaw,
Runcorn,
Cheshire.



THIS PROGRAM runs on the unexpanded Vic-20 and allows you to define eight Basic keywords to the function keys. The Basic program sets up a small machine-code program — 139 bytes — at the top of memory. Therefore, you can run or type fairly long programs while this one is running. There is also an error check in line 40 which ensures you have typed in the data correctly, thereby preventing system crashes.

Four permanent functions are defined:

F1 = Screen colour normal
F = Screen colour black
F5 = Quote mode on
F7 = Quote mode off

And, of course, by using the function keys in conjunction with the Shift and Commodore keys, eight Basic keywords can be printed at the current cursor position on the screen. You can choose any Basic keyword and assign it to its appropriate function key by altering the eight Data values on line 200 respectively.

Some values may give an output of, say, half a keyword for example,

INT (PRINT)

yet by trial and error you should find the desired keyword. These values on line 200 merely state how far into the ROM keyboard table the Vic is to lock before printing out the characters it finds. At present, the function keys are defined as follows:

Shift F1 = PRINT	CBM F1 = FOR
Shift F3 = POKE	CBM F3 = NEXT
Shift F5 = PEEK	CBM F5 = GOTO
Shift F7 = THEN	CBM F7 = GOSUB

To disable the program press run stop and restore. To enable enter Sys 7541.

```
1 REM DEFINED FUNCTION       KEYS
2 REM BY JOHN BRADSHAW"
10 POKE51,117:POKE52,29:POKE55,117:POKE56,29
20 READA:IFA=-1THENFORC=7672TO7679:READA:POKEC,A:NEXT:GOTO40
30 T=T+A:POKE7541+I,A:I=I+1:GOTO10
40 IFT<>17900THENPRINT"█DATA WRONG":END
50 SYS7541:PRINT"█FUNCTION KEYS DEFINED"
60 DATA120,169,130,141,20,3,169,29,141,21,3,88,96,165,197,197,187,240,23,133,18
7,162,1
70 DATA201,39,240,18,232,201,47,240,13,232,201,55,240,8,232,201,63,240,3,76,191
,234,173
80 DATA141,2,201,1,240,50,201,2,240,42,224,1,240,22,224,2,240,26,224,3,240,7,16
9,0,133
90 DATA212,76,191,234,169,1,133,212,76,191,234,169,27,141,15,144,76,191,234,169
,8,141
100 DATA15,144,76,191 ,234,232,232,232,232,189,247,29,133,188,164,188,185,161,1
92,48,8
110 DATA32,210,255,230,188,76,224,29,56,233,128,32,210,255,76,191,234,-1
200 DATA99,89,214,148,0,3,32,48
```

Proc point

John Chalmers,
Godstone,
Surrey.



LYNX BASIC provides no instructions for examining the display, and Peeking it is not possible because of the way it is organised. The routine given in the listing provides the Basic programmer with a method of examining any point on the display. It works by calling a ROM routine which looks at the display RAM. The routine is written as a procedure, so to use it you simply type:

PROC POINT(X,Y)

where X and Y are the co-ordinates of the point you wish to examine. The result will be contained in the variable z on exit from the routine and will be the colour value of the point X,Y. Note how small letter variables are used within the procedure. This would seem like good practice whenever using procedures as extra "commands" — the small letter names are reserved solely for such routines and thus do not corrupt the capital letter names of the main variables. To test the procedure once you have entered it, enter the following lines

```
INK 4
DOT100,100
PROCPOINT(100,100)
?z
```

The z should of course be 4.

```
99990 DEFPROC POINT(x,y)
99991 LET y=((x+256*y)/8),x=INT(y),
      y=2**(7-(FRAC(y)*8)),z=0
99992 CALL &0069,&8000+x
99993 IF (HL BNAND y)>0 THEN LET z=z+1
99994 CALL &0069,&C000+x
99995 IF (HL BNAND y)>0 THEN LET z=z+2
99996 CALL &0070,&C000+x
99997 IF (HL BNAND y)>0 THEN LET z=z+4
99998 ENDPROC
```

Key click

P A Street,
Biggleswade,
Bedfordshire.



THIS KEYBOARD click routine for the Dragon 32 will emit a short click whenever a key is depressed.

The machine-code routine generates a short click, by setting up the sound generator and loading the memory location 65312 with a number, between 0 and 255.

Memory locations 363 and 364 contain the address to which the computer jumps when a key is pressed. This address is changed to the beginning of the click routine. The routine is then started by Poking location 362 with the number 126.

(continued on page 175)

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(continued from page 170)

Enter the program very carefully. Then type Run; the program is Newed and the click routine begins to operate. Adjust the TV's volume control to obtain a preferable volume.

Mnemonics	Hexadecimal Code		
LDA (65315)	B6	FF	23
ORA 8		8A	08
STA (65315)	B7	FF	23
LDA (65281)	B6	FF	01
ANDA 247		84	F7
STA (65281)	B7	FF	01
LDA (65283)	B6	FF	03
ANDA 247		84	F7
STA (65283)	B7	FF	03
LDB 0		C6	00
LDA 0		86	FF
STA (65312)	B7	FF	20
STA (65312)	B7	FF	20
LDA 0		86	00
STA (65312)	B7	FF	20
INC B			5C
BNE -16		26	F0
RTS			39

Listing 2.

```
10 CLEAR 100,32000 : X=0
20 FOR A=32000 TO 32042
30 READ D$ : D = VAL("&H"+D$)
40 POKE A,D : X=X+D
50 NEXT A
60 IF X<>6165 THEN PRINT "DATA
   INCORRECT" : END
70 POKE 363,125 : POKE 364,0
80 POKE 362,126 : NEW
90 DATA B6,FF,23,8A,08,B7,FF,23,B6,FF,01,
   84,F7,B7,FF,01,B6,FF,03,84,F7,B7,FF,03,
   C6,00,86,FF,B7,FF,20,8600,B7,
   FF,20,5C,26,F0,39
```

Weedkiller

Peter Beech,
Kirkham,
Lancashire.



WEEDKILLER RUNS on a 16K or 48K Spectrum. Press keys 5 and 6 to move and the key 0 to drop the weedkiller. Your goal is to stop the weeds reaching the top of the wall.

```
WEEDKILLER (16K or 48K Spectrum)
   0>REM * WEEDKILLER ©P.Beech *
   2 BORDER 1: PAPER 1: CLS : IN
K 7
  10 LET hsc=0
  15 GO SUB 2000: REM **SET UP
  20 LET xo=x
  30 LET a$=INKEY$: IF a$<>"5" A
ND a$<>"6" THEN GO TO 60
  40 LET x=x+(a$="6")-(a$="5"):
IF ATTR (13,x)=15 THEN LET x=xo:
 LET xo=20
  50 PRINT AT 13,x; PAPER 2;"▀";
AT 13,xo; PAPER 2;" "
  60 IF a$="0" THEN GO TO 140
  65 REM **MAKE WEEDS GROW
  70 LET k=INT (RND*16)+1: PRINT
 AT a(k),k+7; INK 4; BRIGHT 1;CH
R$ (144+INT (RND*5)): BEEP .02,k
+5
  80 LET a(k)=a(k)-1: IF a(k)=13
 THEN LET l=l-1: IF l=0 THEN PRI
NT AT 16,12; BRIGHT 1; FLASH 1;"
GAME OVER";AT 18,1; INVERSE 1; F
LASH 0;"0000"( TO 5-LEN STR$ sc)
;sc: GO SUB 9000: LET hsc=(hsc+s
c+ABS (hsc-sc))/2: GO TO 15
  90 IF a(k)=13 THEN GO SUB 4020
: GO SUB 2047: GO TO 20
 100 GO TO 20
 140 PRINT AT 13,x; PAPER 2;"▲";
 FOR f=14 TO a(x-7)-1: PRINT AT
f,x; BRIGHT 1;"ᐱ": BEEP .02,10-f
: NEXT f: FOR f=a(x-7) TO 19: BE
EP .02,10-f: PRINT AT f,x; BRIGH
T 1;"⋂": NEXT f: FOR f=14 TO 19:
 PRINT AT f,x; BRIGHT 1;" ": NEX
T f: LET sc=sc+(19-a(x-7))*10: P
RINT AT 13,x; PAPER 2;"▀"; PAPER
 6;AT 18,1;"0000"( TO 5-LEN STR$
 sc);sc
 150 LET a(x-7)=19: GO TO 70
2010 IF hsc=0 THEN RESTORE : FOR
 f=USR "a" TO USR "h"+7: READ a:
 POKE f,a: NEXT f
2020 LET sc=0: LET l=3
2030 PRINT AT 14,1; INVERSE 1;"S
CORE";AT 17,0;"HISCORE";AT 16,25
;"LIVES";AT 15,1; INVERSE 0;"000
0"( TO 5-LEN STR$ sc);sc;AT 18,1
;"0000"( TO 5-LEN STR$ hsc);hsc
2040 PRINT AT 1,11; INK 6;"Weedk
iller": PLOT INK 6;89,157: DRAW
INK 6;70,0
2041 PRINT AT 4,10;"KEYS 5 and 6
";AT 6,13;"TO MOVE";AT 8,12;"0 T
o DROP";AT 10,11;"WEEDKILLER"
2043 PLOT 73,147: DRAW 110,0: DR
AW 0,-64: DRAW -110,0: DRAW 0,64
2047 PRINT AT 17,26;"▀▀"( TO l-1
);"  ": DIM a(16): LET x=15: FO
R f=1 TO 16: LET a(f)=19: NEXT f
2050 PRINT AT 13,8; PAPER 2;"
                ";AT 20,8; PAPER 3;
"                "
2055 FOR f=14 TO 19: PRINT AT f,
8; BRIGHT 1;"                ":
NEXT f
2060 PRINT AT 13,x; PAPER 2;"▀"
2070 IF l<3 THEN RETURN
2075 IF hsc=0 THEN GO SUB 8000:
RETURN
2080 PRINT AT 16,8; INK 5; BRIGH
T 0;"ANY KEY TO START": GO SUB 4
000: PRINT AT 16,8; BRIGHT 0;"
                ": RETURN
2090 RETURN
3000 DATA 104,120,59,15,55,120,5
6,8,5,8,104,120,56,16,14,8,11,18
,116,126,59,15,14,6,43,63,62,6,1
04,56,24,8,11
3010 DATA 111,126,56,11,111,126,
58,0,127,127,127,62,62,62,0,0,26
,26,62,62,127,127,0,66,66,34,34,
66,65,34,34
4000 IF INKEY$<>"" THEN GO TO 40
00
4005 IF INKEY$="" THEN GO TO 400
5
4010 RETURN
4015 REM **MUSIC
4020 FOR n=1 TO 2: RESTORE 5000
4030 FOR i=1 TO 6: READ h,j: BEE
P h,j-12
4040 NEXT i: NEXT n
4060 RETURN
5000 DATA .1,11,.1,11,.8,16,.05,
11,.05,16,.06,11,.05,16,1,20
8000 DATA 0,6,9,15,9,6,0
8010 LET y=0.001
8020 FOR n=-20 TO 0 STEP 6: REST
ORE 8000
8030 FOR k=1 TO 7: READ x: BEEP
.04,x+n
8040 NEXT k: NEXT n: BEEP 1,n-1
8070 FOR n=0 TO -20 STEP -3: RES
TORE 8000
8090 FOR k=1 TO 4: READ x: BEEP
.04+y,x+n
8100 NEXT k: LET y=y+.002: NEXT
n
8110 BEEP .7,n+1: BEEP .7,n: BEE
P 1.4,n+5
8120 RETURN
9900 RESTORE 9920: FOR f=1 TO 20
: READ a,b: BEEP a/3,b: NEXT f
9915 RETURN
9920 DATA 1,12,.5,12,.5,11,1,9,1
,9,.45,7,.45,9,.45,7,.45,5,.45,4
,.45,2,.45,4,.45,5,1,7,1,0,1,2,1
.5,1.5,4,.5,2,1,0
```

WEEDKILLER GRAPHICS

```
▀=F
▲=G
⋂=H
```

MAIN LOOP

20-60	Test keys,move bucket and call fire routine if required
70-100	Makes weeds grow and tests if game is over or not

OTHER ROUTINES

140-150	Fire routine
2000-90	Initialisation
4020-9920	Various tunes

THE OBJECT OF THE GAME IS TO STOP THE WEEDS GROWING TO THE TOP. INSTRUCTIONS ARE INCLUDED IN THE PROGRAM.

Back-up

H J Thomas,
Wirral,
Merseyside.



THIS PROGRAM is intended to emulate the *Backup command of the disc filing system, but to enable the contents of a disc to be transferred to a cassette tape as a more cost-effective way of protecting a program collection. There was no need for the cassette to contain the !Boot type files, which could not be used from cassette, so only Basic programs needed to be copied.

I was thwarted at first by an apparent error in the BBC Disc Drive Manual — page 74 — which states in its section on Osword, "A=&F7 indicates that a general Read/Write operation is required". The hex should be &7F.

The program could be modified to load all programs on the disc by storing sector 01 at Page &17 and reading the length of program to *Save on to tape. This would then transfer files, machine code or Spooled material as well as Basic programs.

```
10REM Disc to Tape Automatic TransferV2
20REM by H J THOMAS June 1983
30B%=&1800
40*KEYOREM|M*DISC|MPAGE=&1900|MG.130|M
50*KEY1*LOAD"X.XXXXXXX"2000|M
60*KEY2*TAPE|MPAGE=&2000|M
70*KEY3SAVE"X.XXXXXXX"|M
80A%=&7F:X%=&70:Y%=0
90?&70=0:!&71=B%:?&75=3:?&76=&53:!&77=&0:?&79=&21
100PRINT"WHEN DISC & TAPE ARE READY HIT ANY KEY":A=GET
110CALL&FFF1
120IF?&7A<>0 THENPRINT"DISC FAULT":GOTO220
130B%=B%+8:IFB%?7=0 THENGOTO210
140?&B32=B%?7:?&B57=B%?7
150!&B34=!B%:!&B59=!B%:!&B37=B%!3:!&B5C=B%!3
160*FX138,0,129
170*FX138,0,130
180*FX138,0,131
190*FX138,0,128
200END
210PRINT"DISC TRANSFERRED"''
220PRINT"ANOTHER DISC (Y/N) ?"
230ONINSTR("YyNn",GET$)GOTO 240,240,200,200 ELSE 230
240B%=&1800:GOTO100
```

■

COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in August. The name of the winner, the solution, and a competition report will be published in the October, 1983 issue of *Your Computer*.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

COMPETITION RESULTS AND WINNERS

"A MICROLINE 80 printer would make my hard copy easy . . ." was the sentence to be completed in June's crossword competition. As an opening sentence it was perhaps a trifle illogical since hard copy, of course, is not possible without a printer.

Most entries stressed the chore of listing by hand: "If you've done an LList on a Parker 45, you'll know why", said D Lockwood, while A Baker simply completed the rhyme with "because listings by hand make me feel queasy". In the Election month's only political entry A Sewell suggested, "Its Alliance with my computer would be Conservative of my Labcur".

Other entries went to work on the printer manufacturer's name — Oki. "Matrix printers rule — Oki", wrote R Munday and K Butler's entry was "To read — no longer a joki but oki doki". The best in this line came from N Garrat, Brookside, Racton, Near Chichester, West Sussex, with "As all write is OK but OKI is one better, all right" which we made the winner.

F Hindes' "ensuring that the screen show will not leave me feeling listless" was a close contender as was S Taylor's "it would dot my i's by putting dots before my eyes".

In June's android mutiny problem — in the intergalactic hive ship — running the program provided yielded the solution easily enough. When you transfer the blocks which it prints out to the honeycomb grid the number is revealed to be 3.

The program adds together all the dots surrounding each cell, then counts the number of bits set to 1 in the binary representation of that number. If the result equals two it prints a block.

The £15 book token goes to A Maude, Talley, Penglais Road, Aberystwyth, Dyfed, whose answer was the first correct solution picked from the *Your Computer* competition bag. ■

Solution to the June crossword.

A	C	T		I	O	N			P	A	P	E	R	
	U		P		N				U		A		E	
U	T	I	L	I	T	Y		I	T	E	R	A	T	E
	T		O		H				T		A		I	
	O	N	T	H	E	R	I	G	H	T		P	E	T
					W				E					
I	C	E		P	R	I	V	A	C	Y		C	A	P
	H		T		O				L		F		N	
V	I	B	R	A	N	T		P	O	L	O	K	I	T
	P		A		G				C		N		M	
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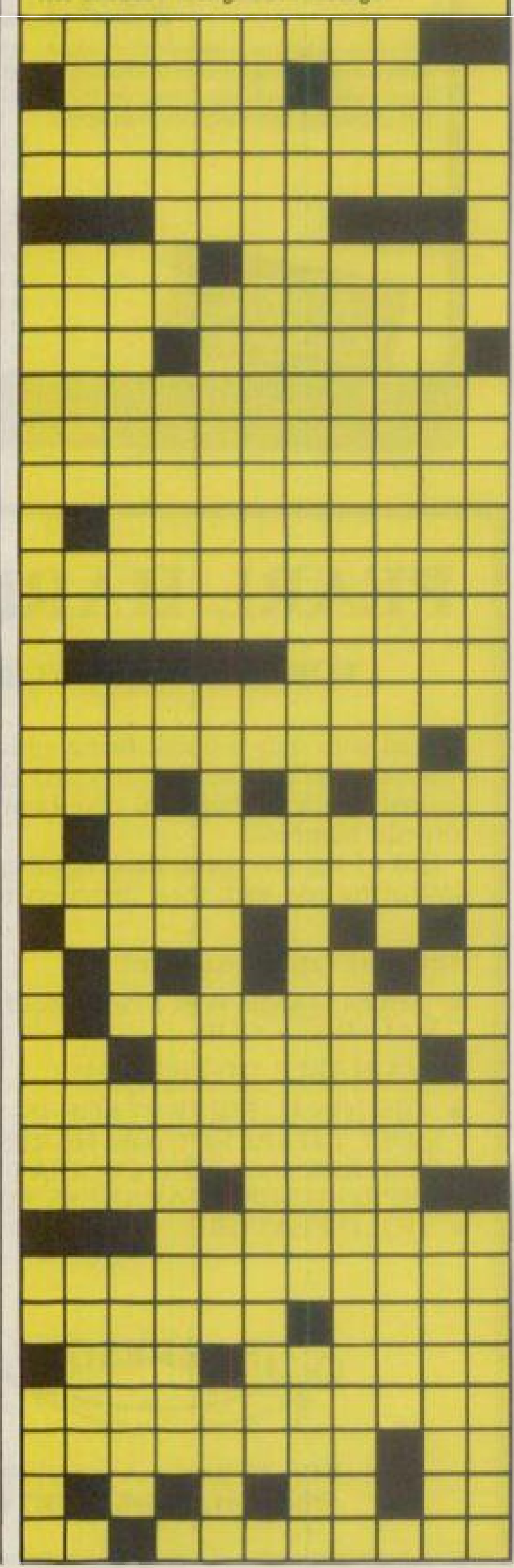
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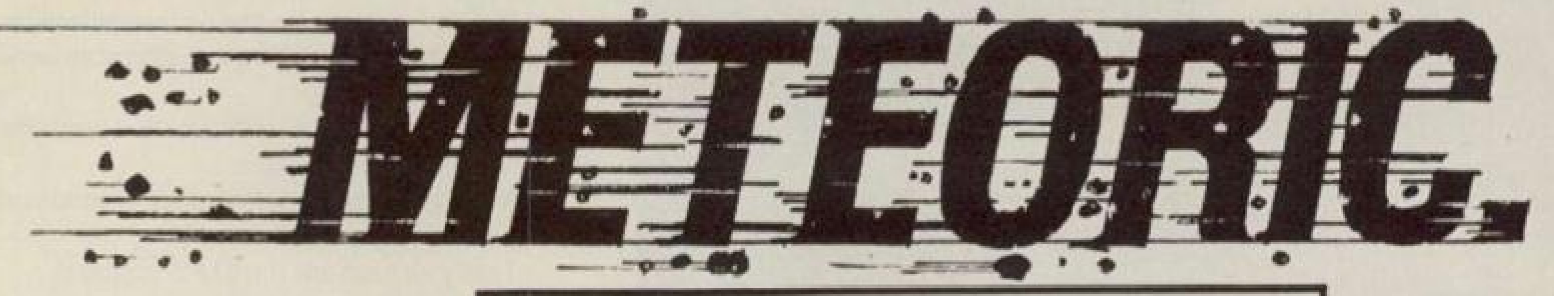
The encoded intergalatic message.

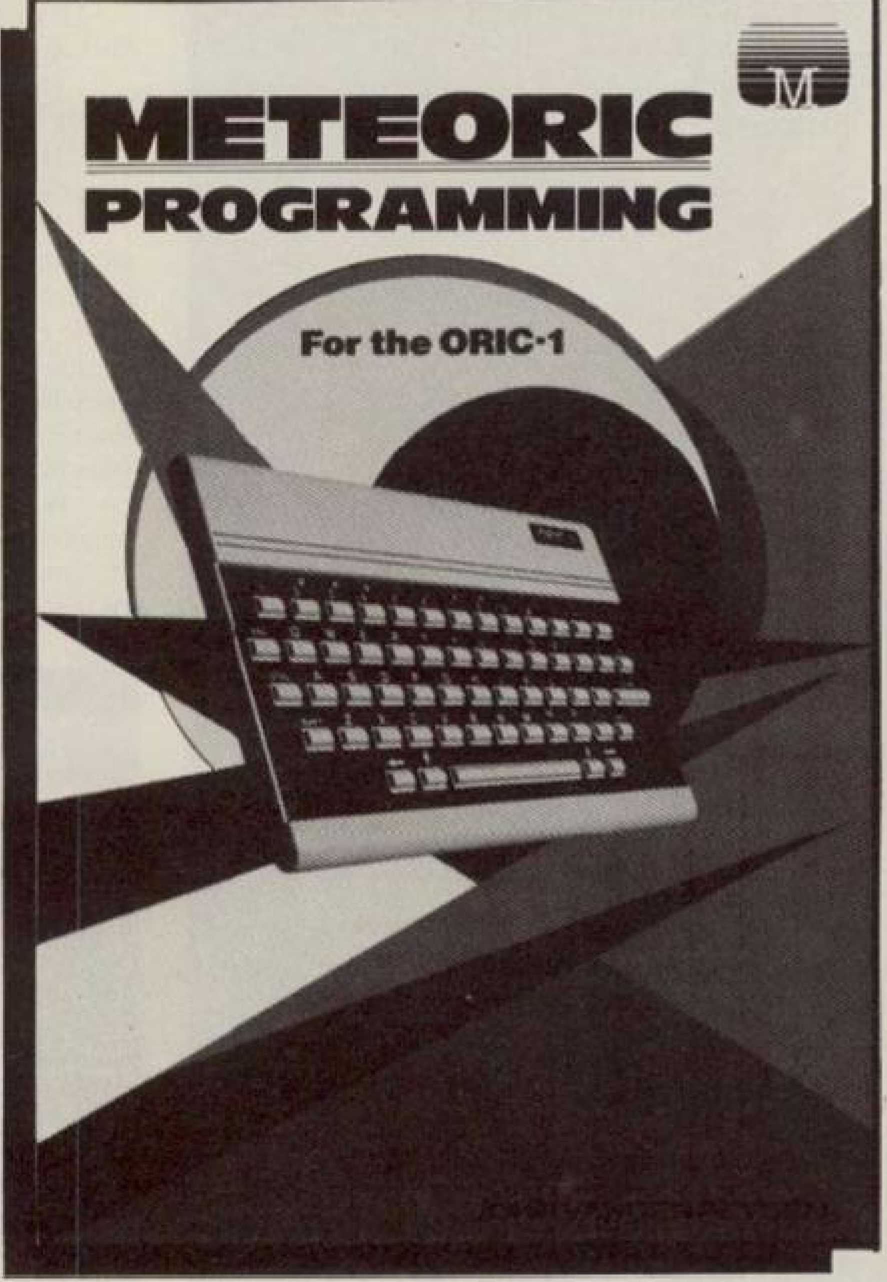



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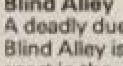
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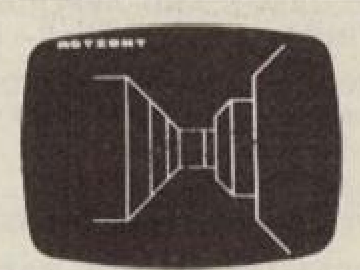
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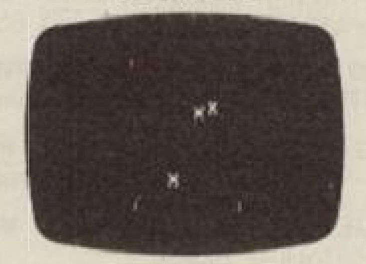
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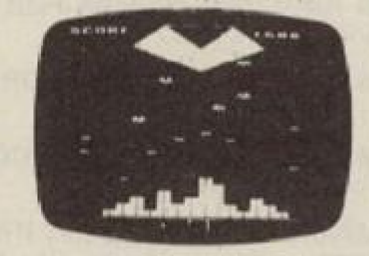
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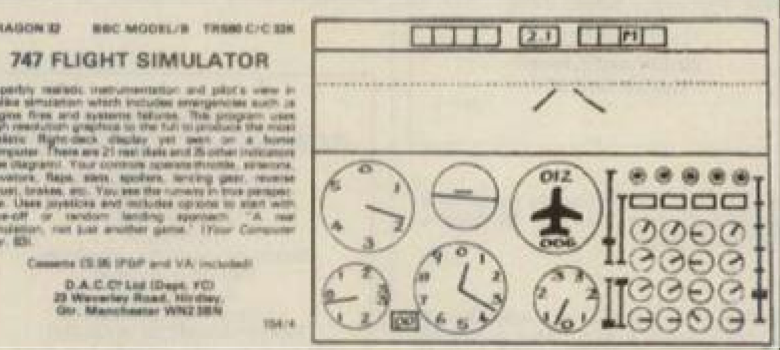
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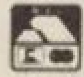
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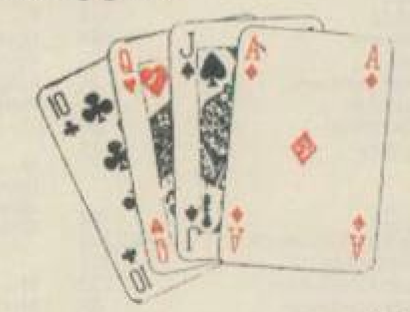
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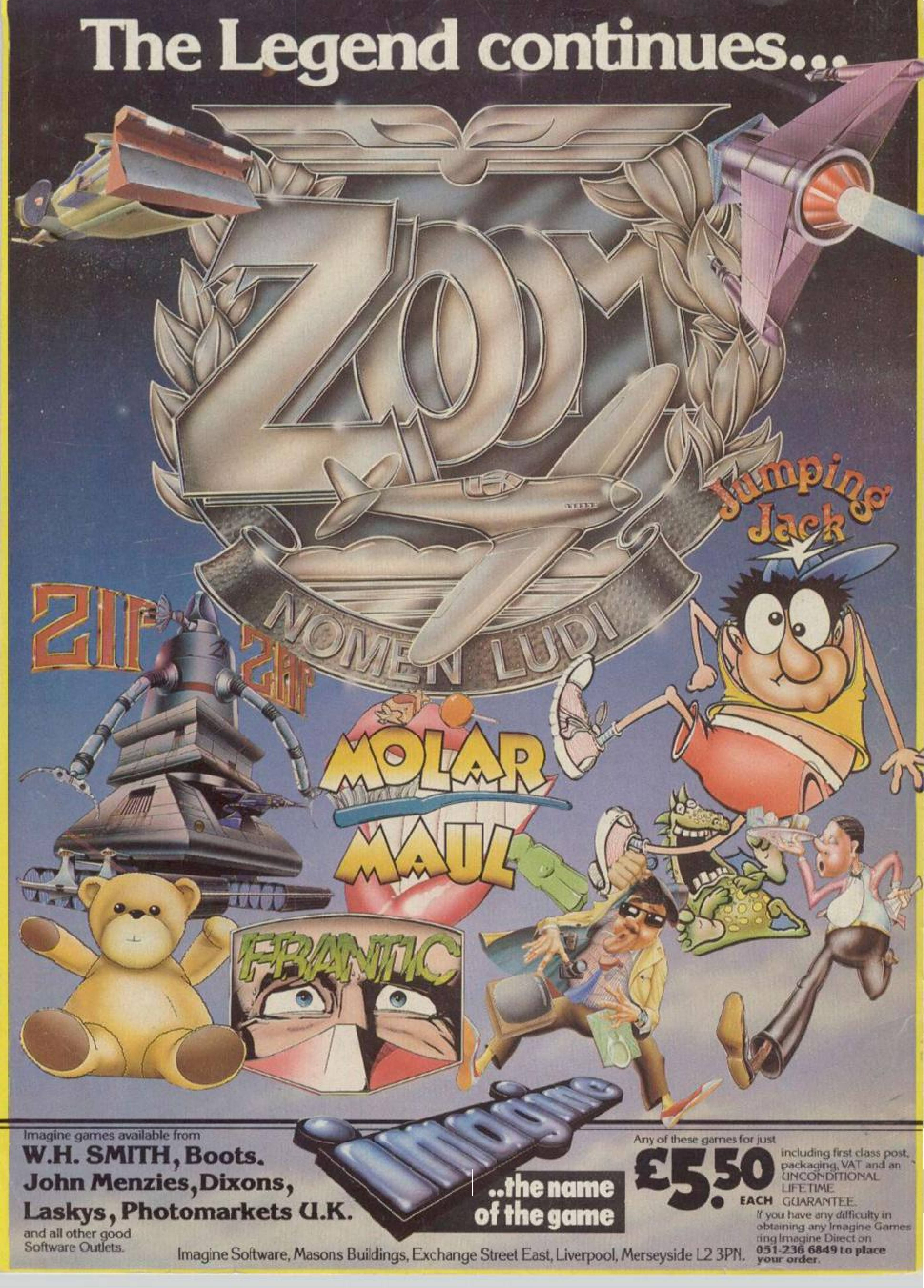
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